UNIVERSITY OF PUNE
[4364]-462
B. E. (Mechanical-Sandwich)
INDUSTRIAL HYDRAULICS AND PNEUMATICS
(2008 Pattern)

Total No. of Questions : 12 **[Total No. of Printed Pages :4]**
[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

(1) Answer any 3 question from section I and 3 question from section II
*(2) Answers to the **two sections** should be written in **separate answer-books**.*
(3) Neat diagram must be drawn wherever necessary.
(4) Black figures to the right indicate full marks.
(5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
(6) Assume suitable data, if necessary.

SECTION-I

Q1.

a) Differentiate between hydrostatic and Hydrodynamics system. [6]
b) A fluid flow at a velocity of 10m/min at entry. The diameter is 50mm and the diameter at exit is 30mm. Determine the flow velocity at exit. Also determine the flow rate in *l*pm [6]
c) Draw and explain the construction and working of simple hydraulics system. [6]

OR

Q2.

a) List and explain some examples of the use of fluid Power equipment in processing food. [6]
b) What criteria Should be considered for selection of oils for a given hydraulic system over mechanical system [6]
c) State the advantages of a hydraulic system over mechanical system [6]

Q3.

a) Explain the basic operation of positive displacement pump. [5]
b) Define Volumetric efficiency, mechanical efficiency and overall efficiency of positive displacement pump. [6]
c) Describe the difference between cavitation and aeration. What is the result of each:- [5]

OR

Q4.

a) A pump that has an overall efficiency at 0.87 and a flow rate of 45 lpm is to be used in a system that has a maximum operating pressure at 25,000 kpa. What input power is required? [6]
b) What is the selection criteria of hydraulic power unit, hydraulic pump, filter, motor, reservoir, necessary pipings, heat exchange etc [10]

Q5.

a) What is the purpose of pressure compensation in flow control value? Explain with schematic. [6]
b) What is the purpose of a pressure reducing value? Describe its operation [5]
c) Why are the pressure override characteristics of a pressure relief valve important? [5]

OR

Q6.

a) Describe the operation of a pilot operated solenoid DCV. What is the advantage of these values over the simple type? [6]
b) What is an accumulator? How does it differ from a reservoir? [5]
c) Compare spring loaded accumulator with a gas charged accumulator explaining their merits and demerits. [5]

SECTION-II

Q7.

a) What is the effect of increasing a motor's displacement on speed and

torque? What is the effect of decreasing the displacement on speed and torque? [6]

b) A cylinder with a 100 mm bore rotates an 300 mm lever arm in a system with a maximum operating pressure of 17,500 kpa. Determine the maximum force of the lever when the angle between the cylinder axis and the perpendicular of the lever arm is 55°. What is the maximum torque of the lever arm at instant? [10]

OR

Q8.

a) Draw a hydraulic motor with meter out flow control of both directions of rotation. [6]

b) Draw and explain a circuit using standard graphic symbols, in which a hydraulic motor is used in conjuction with a hydraulic cylinder. [10]

Q9.

a) List some of the major differences between hydraulics and pneumatics. [6]

b) Describe how vacuum system work. [6]

c) What is the purpose of quick exhaust valve? Where are these valves installed? [6]

OR

Q10.

a) A double acting pneumatic cylinder with a 80 mm bore, 25 mm rod, and a 100 mm stroke length must cycle (extend & retract) 40times per minute. The supply pressure is 700 kpa gauge. What is the air consumption of the cylinder in standard m^3/min? [9]

b) Draw & explain compressed air generation and distribution system [9]

Q11.

a) Explain with a practical example, steps involved in designing a hydraulic circuit. [8]
b) Develop a hydraulic circuit for riveting application. Take arbitrany values [8]

OR

Q12.

a) What is a manufacturer's catalogue. How it helps to a system designer? [8]
b) Design a hydraulic power unit for 500 ton capacity hydraulic press. [8]

[Total No. of Questions: *12*] **[Total No. of Printed Pages:3]**

UNIVERSITY OF PUNE

4364-471

B. E. (Mechanical S/W) Examination - 2013

Energy Management & Industrial Pollution

(2008 Course)

[Time: *3* Hours] **[Max. Marks: 100]**

SECTION -I

Q.1	A	Explain detail Energy crisis. Briefly describe the economic reforms in energy sector.	8
	B	Define components of tariff structures in detail.	8

OR

Q.2	A	Explain in detail commercial and non commercial sources of energy. As a part of energy security what is energy strategy for the future?	8
	B	What are the ways of power factor improvement? Explain in detail.	8
Q. 3	A	Why Sankey diagram is useful in energy balance calculations? Draw a typical Sankey diagram of any thermal System.	9
	B	What are the instrument used in energy audit? Explain any five with principle of working.	9

OR

Q. 4	A	With a suitable example explain in brief energy audit and its methodology.	9
	B	What are the different methods of financial analysis? Explain ROI with example.	9

Q. 5	A	With an example explain energy conservation opportunities in boiler system.	8
	B	Explain the perms related to HVAC systems 1) Sensible and latent loads 2) WBT, DBT, Specific and relative humidity 3) Different load factors	8

OR

Q. 6	A	What are the different techniques of increasing or decreasing the heat loss from thermal system? Explain in detail the concept of critical thickness of insulation.	8
	B	What are energy conservation opportunities in compressed air system? Explain with some suitable example.	8

SECTION II

Q. 7	A	What is fossil fuel? Write a note on the detrimental effects of fossil fuel combustion.	8
	B	Define biodiversity. Write a note on efforts taken for biodiversity conservation.	8

OR

Q. 8	A	Discuss the concept of Emission Trading and clean Development Mechanism.	8
	B	Write short notes on i) Global warming ii) Ozone Layer Depletion	8

Q. 9	A	What is air pollution? Explain in short about different air quality control techniques?	8
	B	How do you define water pollution? What are the different types of water pollution?	8

OR

Q. 10	A	Write short notes on	8

i) Noise pollution
ii) Marine water pollution

	B	Discuss sources of industrial waste water and its effects.	8
Q. 11	A	What are main components of Solid Waste Management?	9
	B	What are the different waste minimization techniques?	9

OR

Q. 12	A	Define sustainability? What are the objectives of EIA?	10
	B	Write short notes on i) E-Waste ii) Waste Heat Recovery	8

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *5*]

UNIVERSITY OF PUNE

[4364]-469

B. E. (*Mechanical S/W*) Examination - 2013

Costing and Cost Control (2008 Course)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions:

1 *Answer any three questions from each section.*

2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*

3 *Neat diagrams must be drawn wherever necessary.*

4 *Figures to the right indicate full marks.*

5 *Assume suitable data, if necessary.*

SECTION -I

Q.1 A State the objectives and importance of cost accounting 8

B Differentiate between financial accounting & cost accounting. 8

OR

Q.2 A Calculate the prime cost, factory cost, cost of production cost of sales and profit from the following particulars: 8

	Rs.		Rs.
Direct Materials	2,00,000	Office stationary	1000
Direct wages	50,000	Telephone charges	250
Direct expenses	10,000	Postage and telegrams	500
Wages of foreman	5,000	Salesmen's salaries	2500
Eclectic power	1,000	Travelling expenses	1,000
Lighting Factory	3,000	Repairs and renewal plant	7,000
office	1,000	Office premises	1,000
Storekeeper's wages	2,000	Carriages outward	750
Oil and water	1,000	Transfer to reserves	1,000
Rent: Factory	10,000	Discount on shares written off	1,000
:Office	5,000	Advertising	2,500
Depreciation Plant	1,000	Warehouse charge	1,000
Office	2,500	Sales	3,79,000
Consumable store	5,000	Income tax	20,000
Managers salary	10,000	Dividend	4,000
Directors fees	2,500		

B State the explain limitations of financial accounting? 8

Q. 3 A Explain the different methods of costing used in manufacturing industries 8

B Explain the detail various parameters used for classification of costs? 8

OR

Q. 4 A What do you understand by direct expenses? What are the characteristics 4

B Are direct expenses more important than indirect expenses? Explain 4

C Define and explain in details the following with suitable examples 8

Manufacturing overheads
Indirect labour cost
Sales and distribution overhead

Q. 5 A In a factory working six days in a week and eight hours each day, a worker is aid at the rate of Rs. 100 per day basic plus D.A. @ 120% of basic. He is allowed to take 30 minutes off during his hours shift for meals-break and a 10 minutes recess for rest. During a week, his card showed that his time was chargeable to : 8

Job x 15 hrs.
Job Y 12 hrs.
Job Z 13 hrs.

The time not booked was wasted while waiting for a job. In Cost Accounting, how would you allocate the wages of the workers for the week?

B State the method of allocation of administration overhead to cost centers or products. 10

OR

Q. 6 A A company has three production departments (M1, M2 and A1) and three service department, one of which Engineering services department, servicing the M1 and M2 only. The relevant information is as follows: 18

Production department	Product X	Product Y
M1	10 Machine hours	6 Machine hours
M2	4 Machine hours	14 Machine hours
A1	14 Direct Labour hours	18 Direct Labour hours

The annual budgeted overhead cost for the year are

Production Department	Indirect Wages (Rs.)	Consumable Supplier (Rs.)
M1	46,520	12,600
M2	41,340	18,200
A1	16,220	4,200
Stores	8,200	2,800
Engineering Service	5,340	4,200
General Service	7,520	3,200

Depreciation on Machinery (Rs.) 39,600
Insurance of Machinery (Rs.) 7,20019
Insurance of Building (Rs.) 3,240
(Total building insurance cost for M1 is one third of annual premium)
Power (Rs.) 6,480
Light ((Rs.) 5,400
Rent (Rs.) 12,675

(The general service deptt. Is located in a building owned by the company).
It is valued at Rs. 6,000 and is charged into cost at notional value of 8% per annum. This cost is additional to the rent shown above)
The value of issues of materials to the production departments are in the same proportion as shown above for the consumable supplies.
The following data are also available:

Department	Book value Machinery (Rs.)	Area (Sq. ft)	Effective H.O. Hours	Production Direct Labour Hours	Capacity Machine hour
M1	1,20,000	5,000	50	2,00,000	40,000
M2	90,000	6,000	30	1,50,000	50,000
A1	30,000	8,000	05	3,00,000	
Stores	12,000	2,000	-		
Engineering Service	36,000	2,500	10		
General service	12,000	1,500	-		

i. Prepare a overhead analysis sheet, showing the bases of apportionment of overhead to departments.
ii. Allocate service department overhead to production

department ignoring the apportionment of service department coast among service departments.

iii. Calculate suitable overhead absorption rate for the productions.

iv. Calculate the overheads to be absorbed by two products, X and Y.

SECTION II

Q. 7 A A cock manufacturing company produces the following products by using 5,000 tonnes of coal @ Rs.15 Per tone into a common process. 8

Coke 3,500
Tar 1,200 tonnes
Sulphate of ammonia 52 tonnes
Benzol 48 tonnes
Apportion the joint cost amongst the products on the basis of the physical unit method.

B Find out the cost of joint products A and B using contribution margin method from the following data: 8

Sales
Product A:100kg @ Rs.60 per kg
Product B:120kg @ Rs. 30 per kg
Joint costs
Marginal cost Rs. 4,400
Fixed cost Rs. 3,900

OR

Q. 8 A Discuss the distinguishing features of process cost system. 8

B What are the methods of apportioning joint costs? Explain any one in brief. 8

Q. 9 A A manufacturing company incurs fixed costs of Rs. 3,00,000 per annum. It is a single product company with annual sales budgeted to be 70,000 units at a sales price of Rs. 300 per unit. Variable costs are Rs. 285 per unit. 8

i. Draw a point volume graph, and use it do determine the breakeven point.

B State the limitations of breakeven analysis 8

OR

Q. 10 A Explain the concept of contribution and contribution to sales ratio in marginal costing 8

	B	Difference between adsorption costing and marginal costing.	8
Q. 11	A	State the basis of standard costing	9
	B	State the need for standard costs	9
		OR	
Q. 12		Write a short note (Any two) 1. Controllable and uncontrollable variances 2. Techniques of marginal costing 3. Types of standards in standard costing	18

UNIVERSITY OF PUNE

[4364]-432

B. E. Mechanical/ Mech SW Examination

- 2013

DYNAMICS OF MACHINERY

(2008 Pattern)

[Time : 3 Hours] **[Max. Marks : 100]**

Total No. of Questions : 12 **[Total No. of Printed Pages :6]**

Instructions :

(1) Answer three questions from each section-I and three questions from section-II.

(2) Answers to the two sections should be written in separate books.

(3) Neat diagrams must be drawn wherever necessary.

(4) Figure to right indicate full marks...

(5) Assume suitable data, if necessary.

SECTION-I

Q.1)

a) Four masses are attached to the shaft a planes A, B, C and D at equal radii. The distance of planes B, C and D from A are 0.5m, 0.6m and 1.3 m respectively. The masses at A, B and C are 60kg, 55kg and 80kg respectively. If the system is in complete balance, Determine the mass at D and the position of masses B, C and D With respect to 'A'. [10]

b) Explain the method of direct and reverse cranks to determine the unbalance forces in redial engines. [06]

OR

Q.2)

a) A shaft is supported between bearings, 2 m apart and extended 0.5 m beyond bearing at each end. The shaft carries three pulleys, one at each end and one at the middle of length. The masses of end pulleys are 50 kg and 25 kg and their centre of gravities are 20 mm and 15 mm respectively from the shaft axis. The centre pulley has [16]

mass of 60kg and its centre of gravity is 20 mm from the shaft axis. If the pulleys are arranged so as to give the static balance, determine:

i. The relative angular positions of the pulleys, and

ii. The dynamic forces produced on the bearings when the shaft rotates at 400 rpm.

Q.3)

a) Determine the natural frequency of the system shown in Fig. 1. [08]
Assume the pulleys to frictionless and of negligible mass.

b) Two slabs of isolators, natural rubber and felt, are kept between a solid mass of 10 kg and the floor as shown in Fig. 2. The natural rubber slab has a stiffness of 3000 N/m and an equivalent viscous damping coefficient of 100 N-sec/m. The felt slab has a stiffness of 12000 N/m and an equivalent viscous damping coefficient of 330 N-sec/m. Determine the undamped and the damped natural frequencies of the system in vertical direction. Neglect the mass of the isolators. [08]

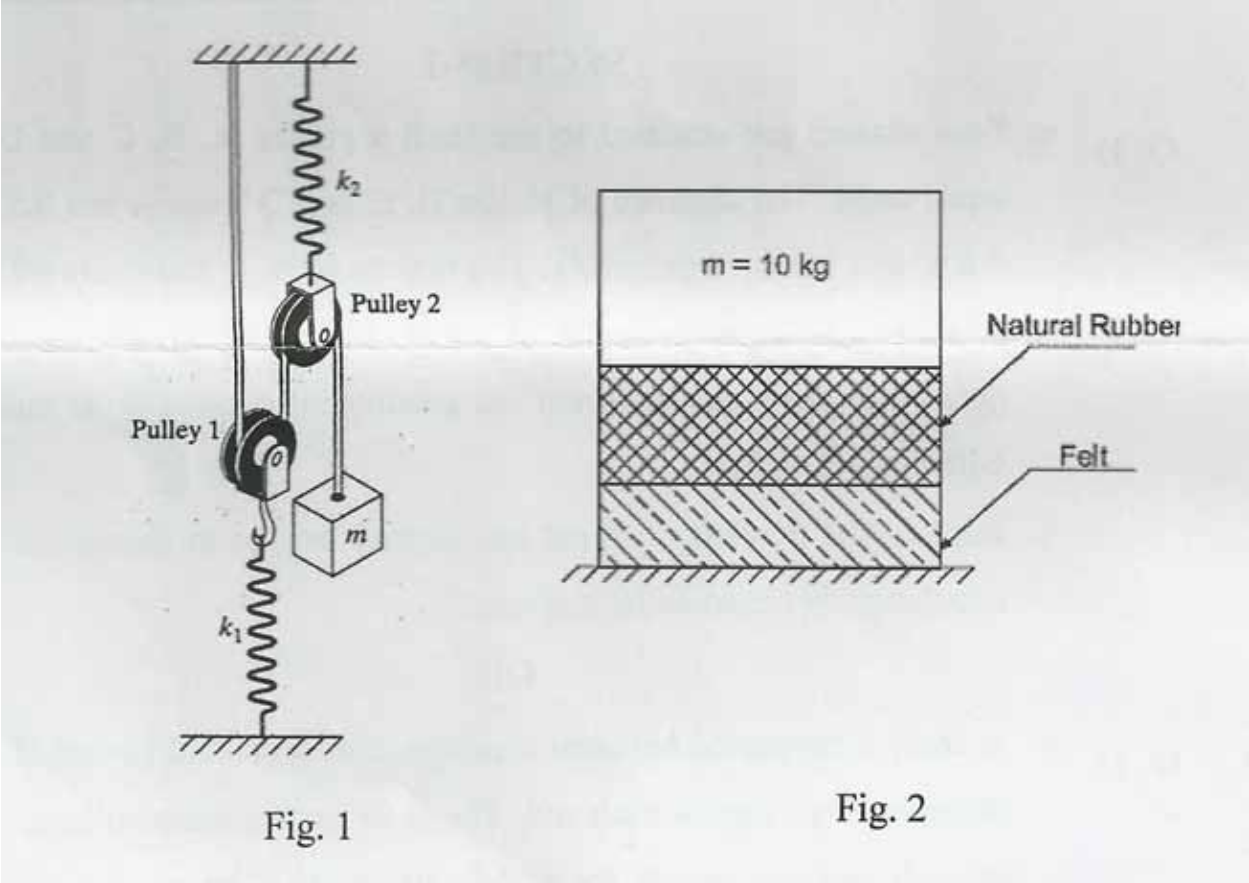


Fig. 1 Fig. 2

OR

Q.4)

a) Discuss Time – Displacement plots for over-damped, critically damped and under-damped system with zero initial displacement. [06]

a) With neat diagram explain longitudinal and transverse vibrations. [04]

b) What are the methods to determine the equation of motion for the vibratory system? Explain any one method with example. [06]

Q.5)

a) The springs of an automobile trailer are compressed 0.1 m under its own weight. Find the critical speed when the trailer is travelling over a road with a profile approximated by a sine wave of amplitude 0.08 m and wavelength of 14 m. What will be the amplitude of vibration at 60 km/hour? [06]

b) Explain forced vibration with rotating unbalance. [06]

c) Explain transmissibility × frequency ratio curve for different amount of damping. [06]

OR

Q.6)

a) The damped natural frequency of a system as obtained from a free vibration test is 9.8 Hz. During the forced vibration test with constant exciting force on the same system, the maximum amplitude of vibration is found to be 9.6 Hz. Find the damping factor for the system and its natural frequency. [06]

b) What are frequency response curve? Give the significance of these curves. [06]

c) Explain transient vibration and steady state vibration related to forced vibration. [06]

SECTION-II

Q.7)

a) Explain two degree of freedom system with any two practical examples. [06]

b) Derive an expression for the natural frequencies and amplitude ratio for the system as shown in Fig. 3, for small displacement in the plane of paper. The pendulum rod is stiff and is pivoted at point O. Also, calculate natural frequencies, when [12]

i. k=∞

ii. $m_2 = 0$

iii. l=0

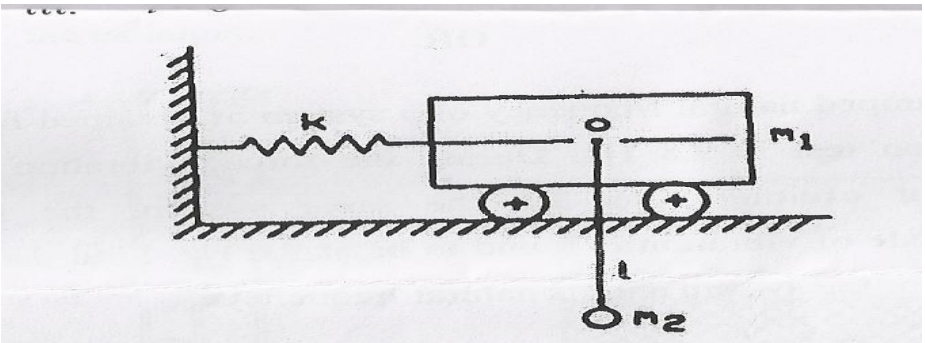


Fig. 3

OR

OR

Q.8) a) Discuss the effect of shaft speed ω, on the shaft carrying single rotor for following conditions $\omega < \omega_c$, $\omega = \omega_c$ and $\omega > \omega_c$. ω_c is the critical speed of the shaft. [06]

b) Marine engine is connected to a propeller through gears as shown in Fig. 4. The mass moment of inertia of flywheel, engine, gear 1, gear 2 and propeller are 9000, 500, 250, 150 and 2000 kg-m^2 respectively. Find the natural frequencies and mode shapes of the system in torsional vibration. Neglect mass moment of inertia of engine, gear 1 and gear 2. [12]

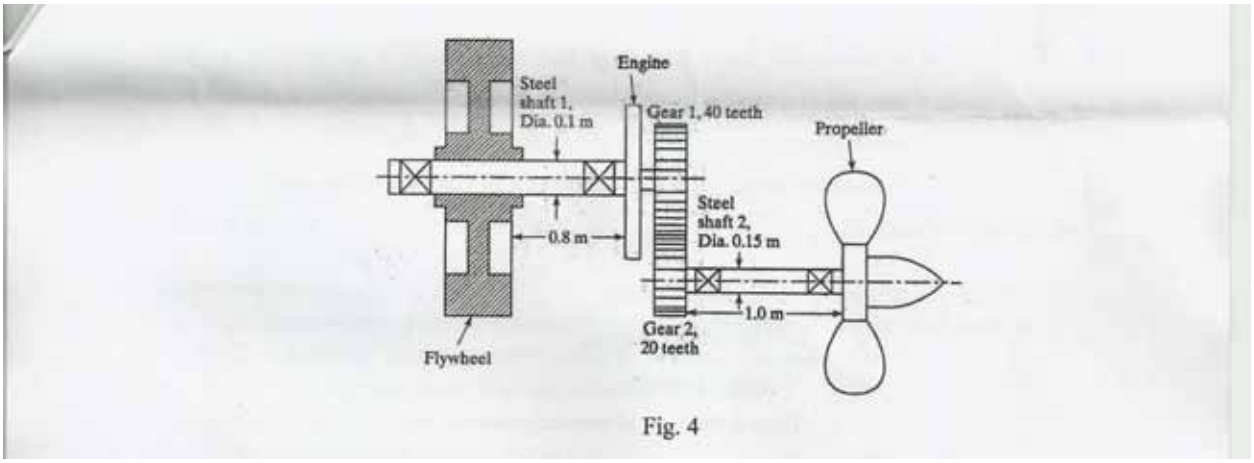


Fig. 4

Q.9) a) A customer care center containing six officers, individually makes noise level of 60, 56, 62, 53, 51 and 54 dB respectively. Add the noise levels when, [04]

i. All officers are working

ii. When first and second officers are not working

b) Write short notes on following: [12]

i. Noise control in industries

ii. Transmission of a sound wave

iii. Sound Fields

OR

Q.10) a) Derive an expression for the relation between sound pressure and sound intensity. [06]

b) Explain the working of sound level meter with neat diagram. [06]

c) Explain radiation fields of a sound source with neat sketch. [04]

UNIT-V

Q.11) a) Explain working principle of Frahm vibration absorber. [04]

b) Explain Frahm's reed tachometer with neat sketch. [06]

c) A vibrometer has a period of free vibration of 2 seconds. It is attached to a machine with a vertical harmonic frequency of 1Hz. If the vibrometer mass has an amplitude of 2.5 mm relative to the vibrometer frame, what is the amplitude of machine? [06]

OR

Q.12) Write short notes on following: [16]

i. FFT spectrum analyzer

ii. Vibration isolation

iii. Time domain and Frequency domain

iv. Sound enclosures

UNIVERSITY OF PUNE

[4362]-188

B E (Mech S/W) Examination - 2013

Robotics *(2008 Course)*

Time: 3 Hrs. Max. Marks: 100

Instructions

1. **Q.1** & **Q.6** are compulsory.
2. Answers to the two Sections should be written in separate books.
3. Figures to the right indicate full marks.
4. Use of electronic calculator is allowed.
5. Assume suitable data, if necessary.

SECTION-I

Q.1 Solve any three from (a),(b),(c) & (d)

a) State three laws of Robotics& discuss the significance of any one of them [6]

b) Discuss various advantages of robotisation [6]

c) Sketch & explain the working of Cartesian gantry type robot.

State it's applications [6]

d) Explain the terms [6]

i) Repeatability

ii) Compliance

iii) Spatial resolution

Q.2 a) Compare Mechanical grippers VsVacuum grippers [5]

b) Discuss various functions performed by sensors [5]

c) Explain one type each [6]

i) Inductive sensor

ii) Capacitive sensor

iii) Optical sensor

OR

Q.3 a) What are different factors to be considered in design of gripper ? [7]

b) Explain with neat sketch (any three)

i) A rotory position sensor

ii) A microswitch

iii) A force sensor

iv) A proximity sensor

Q.4 a) Explain with neat sketch the working of stepper motor.

State it's advantages [8]

b) Compare close loop control with open loop control system [8]

OR

Q.5 a) Compare Pneumatic & Hydraulic actuators w.r.t. their merits & demerits [8]

b) Explain briefly [8]

i) Proportional Control

ii) Proportional + Integral Control

SECTION-II

Q.6 (a) Explain the concept of vision systems. Explain in brief their classification. [08]

(b) Explain imaging devices and image processing techniques used in a robot. [10]

Q.7 (a) Explain Denavit-Hartenberg parameters for assigning frames to links and identifying joint-link parameters. [10]

(b) Explain the limitations of the above method. [6]

OR

Q.8 (a) Explain algebraic approach in inverse kinematics problem for planar 2 DoF RR manipulator. Using this approach determine joint angles for the same manipulator with following data [10]

i. Link lengths: l_1= 120 mm, & l_2= 75 mm
ii. Free end is located at : (100, 70)

(b) Explain the following terms (Any 2) [6]

i. Fixed Angle Representation
ii. Euler Angle Representation
iii. Forward Kinematics

Q.9 (a) Describe various search techniques used with respect to Artificial Intelligence in robots. [8]

(b) Explain various elements constituting robot language and their functions. [8]

OR

Q.10 (a) Explain robot applications in [4]

i. Assembly &

ii. Material handling

(b) State various modes of robot programming. Explain interpolation schemes. [6]

(c) Write short notes on (Any 2) [6]

i. WAIT, DELAY & SIGNAL commands

ii. Motion commands

iii. Subroutines

UNIVERSITY OF PUNE

[4364]-461

B. E. (Mechanical Sandwich Semester I)

Examination - 2013

MCAD MACHINE & COMPUTER AIDED DESIGN

(2008 Pattern)

[Total No. of Questions:] **[Total No. of Printed Pages :6]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

*(1) Answer **any 3questions** from each section.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Black figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

(5) Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed.

(6) Assume suitable data, if necessary.

SECTION-I

UNIT I

Q1. a) Derive the expression for beam strength of a straight bevel gear tooth. How is the wear strength expression modified for straight bevel gears? [8]

b) Compare straight bevel gears with spiral and hypoid gears on the basis of construction, design, limitations and applications. [8]

OR

Q2. a) A worm gear pair is used to transmit 4 kW power from an electric motor running at 1000 rpm to a machine. The worm is quadruple threaded while worm wheel has 52 teeth. Module is 8 mm and the diametral quotient of the worm is 10. The face width of the gear is 58 mm. The worm is made of case hardened steel 10C4 while the worm gear is made of centrifugally cast phosphor bronze having permissible bending stress of 80 N/mm^2.

The coefficient of friction between worm and worm gear teeth is 0.035 while transverse pressure angle is 21.4°. The wear load factor for the worm gear is 0.6 N/ mm^2. With a cooling fan, overall heat transfer coefficient is 22 W/m^{20}C. The external surface area of the housing is 1.35 m^2. Service factor can be assumed as 1.25.

Determine: i) The factor of safety against bending failure.
ii) The factor of safety against pitting failure.
iii) The temperature rise of lubricating oil.

Lewis form factor $Y = 0.484 - \frac{2.87}{z}$

Velocity factor $C_v = \frac{6}{6+v_g}$ [12]

b) Discuss design of worm gear drive as per IS 7443. [4]

UNIT II

Q3. a) A tube of inner and outer diameters 40 mm and 60 mm respectively is reinforced by shrink fitting another tube with outer diameter as 80 mm. The compound assembly is to withstand an internal pressure of 30 MPa. The shrink fit is such that the maximum tangential stress in both tubes is the same. Calculate the shrinkage pressure and the original dimensions of both tubes. Plot the resultant stress distribution.
Assume $E = 2 \times 10^5$ N/mm^2 [12]

b) Explain the design procedure for the saddle support for horizontal pressure vessel with loading diagram and location of the supports. [4]

OR

Q4. a) A hydraulic cylinder with closed ends is made of plain carbon steel 15C8 (S_{ut} = 440 N/mm^2, S_{yt} = 240 N/mm^2) with 250 mm inside diameter is subjected to internal pressure of 30 MPa. Find required thickness of cylinder with factor of safety as 2.
Assume Poisson's ratio = 0.03
Compare the thickness of this cylinder with the one with open ends and comment. [8]

b) A reaction vessel of inner diameter 1000 mm and thickness 20 mm has an inlet pipe of 6 mm thickness and 50 mm inner diameter. Both shell and pipe are of same material with yield strength as 200 MPa.
Design pressure = 3 Mpa
Corrosion allowance = 2 mm
Weld joint efficiency = 0.8
Design the pipe opening and draw a neat sketch of the same. [8]

Q5. a) A shaft and hole assembly of nominal diameter 40 mm has following dimensions. [10]

Diameter mm	Hole		Shaft	
40	+0.01	+0.00	-0.1	-0.15

Assuming hole and shaft diameters normally distributed,
Determine:

i) Percentage of assemblies with clearances less than 0.15 mm

ii) Percentage of assemblies with clearances greater than 0.22 mm

Z	1.0	1.2	1.4	1.6	1.8
Area	0.3413	0.3849	0.4192	0.4452	0.4641

Z	2.0	2.2	2.4	2.6	2.8	3.0
Area	0.4772	0.4861	0.4912	0.4953	0.4974	0.4980

b) Explain the scientific principles of design for a control panel display of a machine tool. [4]

c) Define and explain mechanical reliability and factor of safety. [4]

OR

Q6. a) A cantilever beam is made of plain carbon steel having mean yield strength of 280 N/mm^2 and a standard deviation of 40 N/mm^2. It is subjected to a bending stress with a mean of 180 N/mm^2 and a standard deviation of 20 N/mm^2. Determine:

i) Reliability of the beam

ii) Minimum factor of safety available

iii) Average factor of safety available [8]

b) Explain the aesthetic and ergonomic design principles of car steering wheel with a priority sequence. [6]

c) Explain the principles of design for powder metallurgy. [4]

SECTION-II

UNIT IV

Q7. a) Following data refers to a flat belt conveyor for transporting crushed rock.

- Mass density $\rho = 2$ Ton/m^3
- Belt speed , v = 1.75 m/s
- Belt width, B = 0.8 m
- Surcharge angle, $\alpha = 25°$ for k = 2.35 x 10^{-4}
- Effective width of the material carried by the belt safely,
  b = (0.9 B – 0.05)
  Determine the capacity of the conveyor in Ton/hr. [8]

b) What are the design considerations in selecting the belt speed of a conveyor? [4]

c) Draw and explain different screw take up arrangements in belt conveyors. [4]

OR

Q8. a) Define 'Optimum design'. What is its objective? How the problems of optimum design are classified? Elaborate with suitable examples. [6]

b) A tensile bar of length 500 mm is subjected to constant tensile force of 3000 N. If the factor of safety is 2, design the bar diameter, using Johnson's method, with the objective of minimizing material weight using optimum material from the list given in **Table 8b.** [10]

Material	**Density (ρ) Kg/ m^3**	**Cost (C) Rs/Kg**	**Syt N/mm^2**
Steel	7800	28	400
Aluminum Alloy	2800	132	150
Titanium Alloy	4500	2200	800

Table 8b

Q9. a) A system of spring is shown in Fig. **9a).** Determine overall stiffness matrix and deflection of each spring. [8]

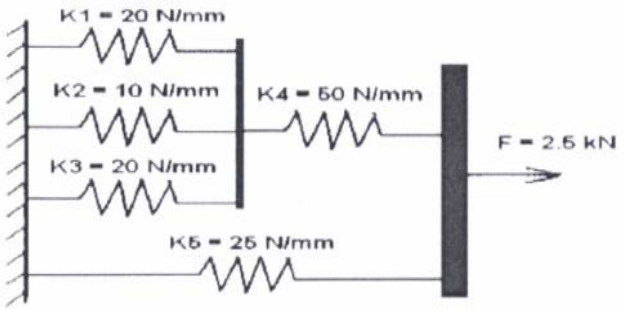


Fig. 9a

b) What is the significance of shape function? Obtain the shape functions for the two noded 1-D elements in terms of natural co-ordinates. [4]

c) Explain elimination approach in brief. [4]

OR

Q10. a) For the truss element, write an equation for elemental stiffness matrix in global co-ordinate system and element stress equation. Find the element stiffness matrix for the two bar truss as shown in Fig. **10a.** [8]

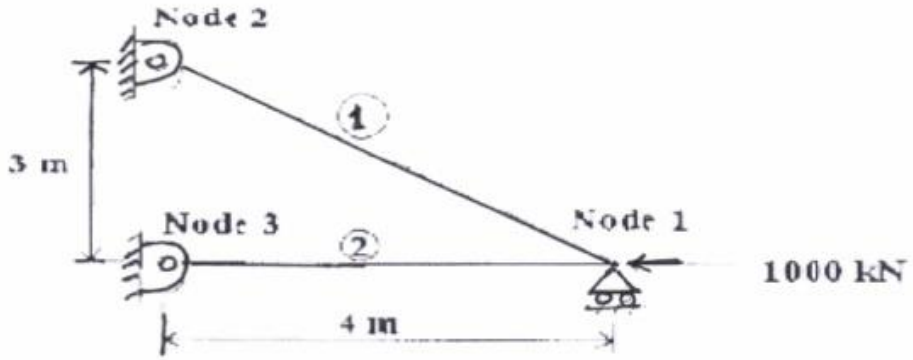


Fig.10a

b) The CST element is defined by three nodes located at (1,1), (4,2) and (3,5). For a point P located inside the element, the shape functions N_1 and N_2 are 0.15 and 0.25 respectively. Determine the x and y co-ordinates of point P. [8]

UNIT VI

Q11. a) What are the features of CNC machines as compared to NC machines? [6]

b) Write a manual part program for turning a raw bar of diameter 60mm and 52 mm long as per the following drawing using canned cycles. [8]

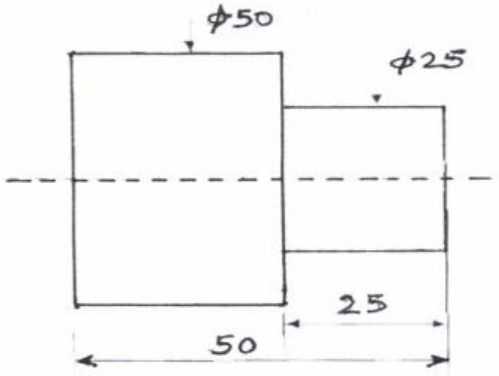


Fig.

c) Explain Computer Integrated Manufacturing (CIM). [4]

OR

Q12. a) Discuss need for flexibility in automation system. [6]

b) What are different FMS layout configurations? [6]

c) Explain the concept of hard and soft automation with suitable examples. [6]

UNIVERSITY OF PUNE

[4364]-463

BE (Mechanical Engineering – Sandwich), Examination April-May 2013.

Refrigeration and Air-Conditioning (2008 course)

Elective II

[Total No. of Questions: 12] **[Total No. Printed Pages: 3]**

[Time: 3 Hours] **[Max. Marks: 100]**

Instructions :

*(1) Answer any **three questions** from each section.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Black figures to the right indicate full marks.

(6) Assume suitable data, if necessary.

SECTION I

Q 1 a) Write a note on "Magnetic Refrigeration". [6]

b) What are the advantages and limitations of Air Refrigeration Systems? Explain Boot Strap system with the help of T-S diagram. [10]

OR

Q 2 a) Explain the concept of DART. [6]

b) A simple system is used for and aeroplane to take the load of 25TR. Atmospheric temperature and pressure conditions are 23^0C and 0.9 bar respectively. The pressure of air increased due to isentropic ramming to 1.1 bars. The pressure of air leaving the main compressor is 3.5 bars and temperature of air at the exit of air cooler is 75^0C. The air is then supplied to the cabin where pressure is maintained at 1.03 bar. Assuming isentropic efficiencies of the compressor and turbine are 85% respectively. Determine.

i) Power required taking the load in the cooling cabin.

ii) COP of the system.

The temperature of the air leaving the cabin should not exceed 25^0C. [10]

Q3 a) How the refrigerants are classified? What are the essentials properties of a good refrigerant? [6]

b) Explain the following terms: [12]

I) Ozone Depletion Potential

II) Global Warming Potential

III) TEWI

OR

Q 4 a) Write note on "Refrigerant Recovery, Recycling and Reclaiming. [6]

b) Discuss, in detail, the secondary refrigerants. [6]

c) Write a note on "Refrigerant and lubricating oil" [6]

Q 5 a) What is the necessity of multi-staging? Explain Cascade system with the help of a sketch and P-h diagram. [8]

b) Explain analysis of a refrigeration system having three evaporators at different temperatures with compound compression, individual expansion valves and flash intercoolers. using schematic dia. & P-h dia. [8]

OR

Q 6 a) What is the function of the following components in an vapor absorption absorption refrigeration system. i) Absorber ii) Rectifier iii) Analyzer iii) Heat Exchangers [8]

b) Explain Electrolux system with a neat sketch [8]

SECTION II

Q 7 a) Compare: Unitary air conditioning and central air conditioning [4]

b) write a short note on Automobile air conditioning system. [4]

c) Explain the following with hand drawn psychrometric chart [8]

I) ADP

II) RSHF

III) ERSHF

IV) GSHF

OR

Q 8 a) Write short notes on [10]

i) Transform refrigeration.
ii) In-filtration and ventilation load in air conditioning.

b) Explain the various industrial applications of air-conditioning. [6]

Q 9 a) Write short notes on: "Operating and Safety controls in refrigeration system" [8]

b) With neat sketch explain working of Thermostatic Expansion Valve. [8]

OR

Q10 a) Describe the different materials used for duct. Classify duct. [8]

b) Derive equation for the equivalent circular diameter of a rectangular duct. Take a and b are longer and shorter sides of a rectangular duct. [8]

Q 11 a) Explain the factors which are responsible for the spoiling food and vegetables? What are the methods for preservation of food and vegetables?

[12]

b) Write a note on Marine Refrigeration". [6]

OR

Q12 a) What is cryogenics? Discuss the limitations of vapor compression refrigeration systems for production of low temperature. [8]

b) Describe the methods adopted for liquefaction of hydrogen and helium.

[10]

UNIVERSITY OF PUNE

[4364]-464

B. E. (Mech Sandwich) Examination - 2013

COMPUTATIONAL FLUID DYNAMICS(ELECTIVE-II) (2008 Pattern)

[Total No. of Questions:12] **[Total No. of Printed Pages :3]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

*(1) Answer **any three** from each section.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Black figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

(5) Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed.

(6) Your answers will be valued as a whole.

(7) Assume suitable data, if necessary.

SECTION-I

Q1 a) Obtain momentum equation using any flow model. [12]

b) Write few comments on Navier-Stokes equations. [4]

OR

Q2 a) Give impact of CFD in automobile and civil engineering with 2 examples each [8]

b) Explain the concept of substantial derivative in CFD [8]

Q3 a) Obtain finite difference quotient for $\frac{\partial^2 u}{\partial x dy}$ over a grid having running index i j in x & y direction respectively. [10]

b) List & discuss types of errors occurring in numerical/computational calculations. [8]

OR

Q4 a) Solve $\frac{d^2u}{dx^2}$ - $y^2\frac{dy}{dx}$ = x subject to the conditions at x=1, y=2, [9]

$\frac{dy}{dx}$=1 & calculate y at x=1.2 taking h=0.2

b) Identify and classify following PDE's into elliptic, parabolic & hyperbolic [9] equations. Also give practical example for each type

1) $\frac{\partial T}{\partial t} = \propto \frac{\partial^2 T}{\partial x^2}$ 2) $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2}$ 3) $\frac{\partial y}{\partial t}$ + c $\frac{\partial y}{\partial x}$=0

Q5 a) Discuss modern developments in grid generations. [8]

b) What is Transformation in grid generation? Explain its need with the help [8] of physical & computational plane

OR

Q6 a) Give solution algorithm for thermally developing fluid flow inside 2D [16] channel.

SECTION-II

Q7 a) 1 D heat conduction equation for pin fin is given by [12]

$$\frac{\partial^2 T}{\partial x} - \frac{hp}{ka}(T-T\infty)$$

Where h = heat transfer coefficient (w/m^2 k)

p = perimeter

a = Cross sectional area (m^2)

k = Thermal conductivity for fin material(w/m k)

T∞ = Ambient temperature at the free end.

Give solution algorithm for finding temperatures at various nodal points.

b) Compare explicit and implicit methods by discussing on minimum 3 points.[6]

OR

Q8 a) Consider 2D transient heat conduction over a grid of 4x4 with governing[18] equation.

$$\frac{\partial T}{\partial t} = \propto \left(\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2}\right)$$ where ∝=k/ϱcp

Given

1) Temperature of plate at t = 0 is 140°c

2) Lower boundary temperature is constant =140°c

3) T∞ = surrounding temp = 25°c

4) q= 8000 w/m^2, h= 80 w/m^2°c, k=15w/m°c

$\propto = 3.2 \times 10^{-6} m^2/s$

Determine temperatures of notes 1 to 12 after 15 sec

Q9 a) Explain SIMPLE algorithm. Draw flow chart for the same [10]

b) Explain the concept of staggered grid [6]

OR

Q10 a) Explain Mac Cormack technique comment on its comparison with Lax Wendroff technique [12]

b) Out of integral & differential form of equations which form is used in commercial software of CFD & why? [4]

Q11 a) Give different flow used for studying (simulating) the fluid flow [6]

b) Give advantages & disadvantages of finite volume method. [6]

OR

Q12 Write short notes on any two of the following [16]

i) Errors in CFD

b) Lax Wendroff technique

c) Artificial viscocity

d) Use of CFD in Automobile applications

[Total No. of Questions:] **[Total No. of Printed Pages: 5]**

UNIVERSITY OF PUNE

[4364]-465

B. E. (*Mechanical S/W*) Examination - 2013

(Finite Element Method)(Elective-II)(2008 Course)

[Time: *3* Hours] **[Max. Marks: 100]**

Instructions:

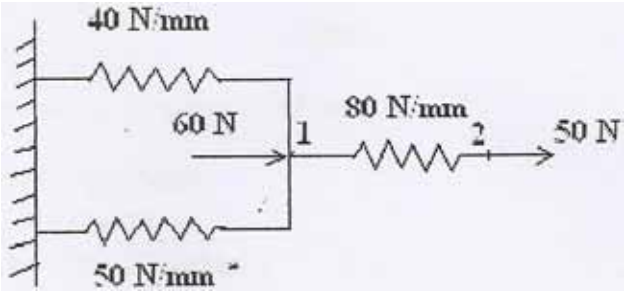
1. *Answers to the **two sections** should be written in **separate answer-books**.*
2. *Numbers to the right indicate **full marks.***
3. *Assume suitable data, if necessary.*
4. *Use of electronic pocket calculator is allowed.*
5. *Answer **any three** from each **section.***

SECTION -I

Q.1	A	Explain in brief the steps involved in Finite Element Method.	5
	B	Derive and plot shape functions, $N_1 = \frac{x}{L} and N_2 = \frac{X}{L}$ for a linear spring element of length 'L'. Use direct equilibrium approach.	6
	C	Explain the principle of minimum potential energy used in deriving element stiffness matrix and equations.	5

OR

Q.2	A	Define the term FEM. Explain in brief it's general applications.	4
	B	Write short note on **(Any 2)** i. The Rayleigh-Ritz Method ii. Plane stress and plane strain problem iii. The Galerkin Method iv. Sources of errors in FEM	6
	C	Determine the displacements of nodes of the spring system as shown in **Fig.Q.No.(2)c.** Use Principle of minimum potential energy.	6

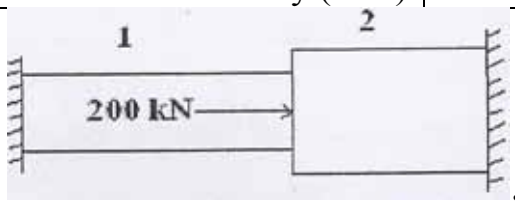


Q. 3 A For a one-dimensional bar element with two nodes 'i' and 'j' along x-direction, assuming linear behavior of bar element, derive bar element stiffness equation based on Potential Energy approach. Use the shape functions Ni and Nj as, Ni=$\frac{xj-x}{L}$ at node 'i' and Nj=$\frac{xj-x}{L}$ at node 'j'. 'L' be the length of the bar element. 6

B A bar consists of two steps as shown in **Fig. Q.No.3(c)** below. An axial load F=200kN is applied as shown. Model the bar with two finite elements. Determine, 10

i. Element stiffness matrix
ii. Global stiffness matrix
iii. Global load vector
iv. Nodal displacements
v. Stresses in each bar

Sr. No.	Items	Elements	
		1	2
1	Length(mm)	200	100
2	Area(mm^2)	1000	2000
3	Modulus of Elasticity (GPa)	200	83

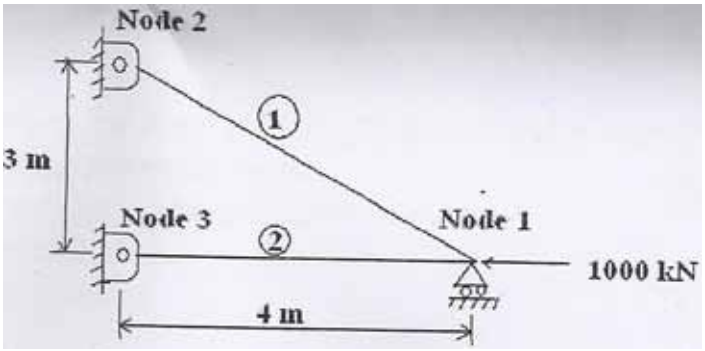


OR

Q. 4 A Explain the following terms in brief**(Any 2)** 6

i. Elimination Approach
ii. Penalty Approach
iii. Quadratic shape functions
iv. Characteristics of Global stiffness matrix.

B For the truss element, write an equation for element stiffness matrix in global coordinate system and element stress equation. Find the element stiffness matrix for the two bar truss as shown in **Fig.Q.No4(b)** below. 10



Q. 5 A What is CST element? Explain natural coordinates and shape functions for CST element. Write an equation for element strain vector in terms of element strain nodal displacement matrix and element nodal displacement vector for CST element. 8

B Draw four noded quadrilateral element both in Cartesian coordinates and in natural coordinates for a quadrilateral plate with following data, 10

Vertices	Cartesian coordinates (mm)	Displacements(mm)
1	10,10	0.2
2	50,20	0.7
3	60,50	0.9
4	30,70	0.6

The point 'M' within the element has Cartesian coordinates (30,40). For this point 'M', determine

i. The nodal coordinates
ii. The shape functions
iii. The displacements

OR

Q. 6 A Draw eight noded quadrilateral in Cartesian and in natural coordinates 2

B Model the triangular plate of thickness 10 mm as a CST element. The coordinates of three vertices of the plate are as shown in table below. Take E=2.1 $\times 10^5 N/mm^2$, and Poisson's ratio=0.25 for the plate material. 16

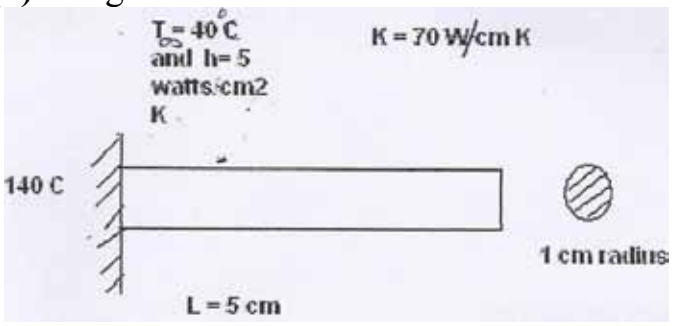
Vertices	Cartesian coordinates(mm)	Deflections(mm)	
		u(mm)	v(mm)
1	10,10	$u_1 = 0.01$	$v_1 = 0.04$
2	70,35	$u_2 = 0.03$	$v_2 = 0.02$
3	25,75	$u_3 = 0.02$	$v_3 = 0.05$

Determine,

i. The deflections at the point N(40,30) within the element
ii. Element stress-strain matrix
iii. Element strain nodal displacement matrix
iv. Element strains
v. Element stresses

SECTION II

Q. 7	A	Explain in brief the types of Boundary conditions used in FEA.	4
	B	Explain the types of coordinate system used in FEA.	4
		OR	
Q. 8	A	Explain element formulation in FEA.	4
	B	Explain Symmetry and unsymmetry loads and boundary condition.	4
	C	Write a short note on natural or intrinsic coordinate system. Derive the relation to map the natural system with the global coordinate system for a 1D element.	8
Q. 9	A	How are thermal effects considered in a truss element? Derive the necessary relation to determine stresses considering thermal effects.	10
	B	Find the temperature distribution in 1D fin shown in **Fig.9(b)** using one finite element.	8



OR

Q. 10	A	State and explain the governing equation for 1dimensional heat flow.	8
	B	Prove that for a 1D linear element, stress developed would be,$\sigma = E(Bq - \propto \Delta T)$ Where $\propto$= Coefficient of thermal expansion ΔT=Change in Temperature	10
Q. 11	A	What are the functions and phases of Finite Element Analysis software.	5
	B	Explain with examples the types of nonlinearities in FEA.	6
	C	Differentiate the consistent and lumped mass matrices in	5

dynamic analysis

OR

Q. 12	A	Explain in brief the Implicit and Explicit solver used FEA Software.	4
	B	State & explain governing equation of a dynamic system in FEA	4
	C	Define with examples: i. Modal Analysis ii. Harmonic Analysis iii. Fatigue Analysis iv. NVH Analysis	8

University of Pune
B.E. (Mechnical (S/W))
4364-466
Examination May-2013
Automobile Engineering
(2008 Pattern)

Total No. of Questions : 12 **[Total No. of Printed Pages :3]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

*(1) Answer **03 question from each section.***
*(2) Answers to the **two sections** should be written in **separate answer-books**.*
(3) Figures to the right indicate full marks.
(4) Use of calculator is allowed.
(5) Neat diagrams must be drawn whenever necessary.
(6) Assume suitable data, if necessary.

Section I

Q1. A) With a neat sketch explain the construction of the frameless body. [6]
B) Explain main advantages of above construction. [6]
C) Explain stress induced in the side members of truck chassis.
Justify Selection of C crosses section of side members. [6]

OR

Q2. A) Explain various sections used for side members and cross members of chassis frame. [6]
B) State various advantages of using rear engine layout for long buses. [6]
C) Explain the terms (any two) [6]
1. Air resistance
2. Rolling resistance
3. Grade resistance

Q3. A) With a neat sketch explain the operation of single plate clutch. [6]
B) Explain the need of universal joints in propeller shaft. [3]
C) Why spur gears are required in sliding mesh gear box? [3]
D) what do you understand by double declutching? [4]

OR

Q4. A) State the functions of [6]

1. Clutch
2. Gearbox
3. Propeller shaft

B) Explain with neat sketch (any one) [6]

1. Semi floating rear axle
2. Full floating rear axle

C) What are the advantages of multiplate clutch? [4]

Q5. A) Explain with neat sketch (any three) [6]

1. Castor
2. Camber
3. King ping inclination
4. Center point steering

B) what do you understand by independent suspension? Where is it used? Explain. [4]

C) Explain with neat sketch the operation of disc brake [4]

D) What are the desirable characteristics of brake pad? [2]

OR

Q6. A) Explain with neat sketch of Hydraulic power steering [6]

B) Draw and explain the arrangement of mounting of a leaf spring in trucks [5]

C) What are different factors contributing to A.C. - load in cars? [5]

Section II

Q7. A) Describe with neat sketch layout for an automobile repair garage. [8]
Discuss different sections in it needed for repair and maintenance of automobile.

B) What do you understand by servicing of brake system? Prepare the check point list for servicing of brake system. [8]

OR

Q8. A) Classify various systems of engine lubrication. Draw flow diagram of oil showing various parts in a pressure feed system.
What maintenance is required for the lubrication system? Explain. [8]

B) Prepare maintenance schedule plan for three cylinder petrol engine of an automobile of your choice. [8]

Q9. A) What is role of safety in automobile? Explain various safety systems incorporated in modern days automobile. [8]

B) Explain construction and details of an automobile seat. What are various parts of it? Explain with neat sketch. [8]

OR

Q10. A) Explain role of the following in automotive safety. [8]

1. Air bags
2. Head restraint

B) Sketch various types of body structure used in automobile.
Describe importance of the vehicle structure regards to crashworthiness of it. [8]

Q11. A) Explain the following: [10]

1. Construction of an automobile head lamp.
2. Warning devices in automobile.

B) Explain various microprocessor applications in today's automobile. [8]

OR

Q12. Write short note on the following. (Any three) [18]

1. Electronics Control Unit (EUC)
2. Use of Sensors in automobiles.
3. Antilock Brake System. (ABS)
4. New technology in automotive lighting.

Total No of Questions: [12] *SEAT NO. :*

XXXX
[Total No. of Pages : 5

XXXXXX
B.E. (Mechanical SW)
OPERATIONS RESEARCH
(2008 Pattern) (Elective - I) (Semester - I)

Time: 3 Hours *Max. Marks : 100*

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Select Q.1 or Q.2,Q.3 or Q.4,Q.5 or Q.6 from section I and Q.7 or Q.8,Q.9 or Q.10,Q.11 or Q.12 from Section II***
5) ***Use of Calculator is allowed.***
6) ***Assume Suitable data if necessary.***

SECTION I

Q1) a) Solve the following problem graphically: [08]

Maximize $Z = - x_1 + 4x_2$,
Subject to $-3x_1+x_2 \leq 6$,
$x_1 + 2x_2 \leq 4$,
$x_2 \leq -3$,
No lower bound constraint for x_1.

b) Define : 1) Feasible Solution 2) Feasible Region 3) Infinity solution 4) Optimal solution [08]

OR

Q2) a) Solve the Problem by simplex method. [08]

Minimize $Z = x_2 - 3x_3 + 2x_5$,
Subject to $x_1 + 3x_2 - x_3 + 2x_5 = 7$,
$-2x_2 + 4x_3 + x_4 = 12$,
$-4x_2 + 3x_3 + 8x_5 + x_6 = 10$,
$x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$.

b) Solve the following problem using the Big M method: [08]

Maximize $Z = 6x_1 - 3x_2 + 2x_3$,
Subject to $2x_1 + x_2 + x_3 \leq 16$,
$3x_1 + 2x_2 + x_3 \leq 18$,
$x_2 - 2x_3 \geq 8$,
x1, x2, x3 ≥ 0.

Q3) a) A company manufacturing air coolers has two palms located at Mumbai and Kolkata with capacity of 200 units and 100 units per week respectively. The company supplies the air coolers to its four show rooms situated at Ranchi, Delhi, Lucknow and Kanpur which have a maximum demand of 75,100,100 and 30 units respectively. Due to the differences in raw material cost and transportation cost, the profit per unit in rupees differs which is shown in the table below.

	Ranchi	Delhi	Lucknow	Kanpur
Mumbai	90	90	100	100
Kolkata	50	70	130	85

[08]

Plan the production programme so as to maximize the profit. The company may have its production capacity at both plants partly or wholly unused.

b) A company has a team of four salesmen and there are four districts where the company wants to starts its business. After taking into account the capabilities of salesmen and the nature of districts. The company estimates that the profit per day in rupees for each salesman in each district is as below.

		Districts			
		1	2	3	4
Salesmen	A	16	10	14	11
	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

Find the assignment of salesmen to various districts which will yield maximum profit. [08]

OR

Q4) a) A company has four factories at four different places, which supply warehouses A, B, C, D and E monthly factory capacities are 200,175,150 and 325 units respectively. Monthly warehouse requirements are 100, 90, 120,230 and 160 units respectively .unit shipping costs are given in table as follows. The costs are in rupees. [08]

From To	A	B	C	D	E
1	13	--	31	8	20
2	14	9	17	6	10
3	25	11	12	17	15
4	10	21	13	--	17

Shipment from 1 to B and from 4 to D is not possible. Determine the optimum distribution to minimize shipping costs.

b) A salesman wants to visit cities A, B, C, D and E. He does not want to visit any city twice before completing his tour of all the cities and wishes to return to the point of starting journey. Cost of going from one city to another in rupees is shown below table. Find the least cost route. [08]

	A	B	C	D	E
A	0	2	5	7	1
B	6	0	3	8	2
C	8	7	0	4	7
D	12	4	6	0	5
E	1	3	2	8	0

Q5) a) A company uses Rs. 10,000 worth of an item during the year. The ordering costs are Rs. 25 per order and carrying charges are 12.5 % of the average inventory value. Find the economic order quantity, number of orders per year, time period per order and total cost. [10]

b) What is dynamic programming? Write step by step procedure to solve a general [08]

problem by dynamic programming approach.

OR

Q6) a) The owner of a chain of four grocery stores has purchased six crates of fresh strawberries. The following table gives the estimated profits at each store when it is allocated various number of boxes.

Number of Boxes	Stores 1	2	3	4
0	0	0	0	0
1	4	2	6	2
2	6	4	8	3
3	7	6	8	4
4	7	8	8	4
5	7	9	8	4
6	7	10	8	4

The owner does not wish to split crates between stores, but is willing to make zero allocations. Find the allocation of six crates so as to maximize the profits. [10]

b) Define inventory .what are the advantages and disadvantages of having inventories. [08]

SECTION II

Q7) a) Solve the following game:

Player A	Player B: B_1	B_2
A_1	30	2
A_2	4	14
A_3	6	9

[08]

b) The purchase price of machine is Rs. 52,000.the installation charges amount to Rs. A4,400 and its scrap value is only Rs. 6400.the maintenance cost in various years is given below:

Year	1	2	3	4	5	6	7	8
Maintenance cost	1,000	3,000	4,000	6,000	8,400	11,600	16,000	19,200

After how many years should the machine be replaced? Assume that the machine replacement can be done only at the year ends. [08]

OR

Q8) a) Solve the following 2×4 game by graphical method:

A	B: 1	2	3	4
1	3	3	4	0
2	5	4	3	7

[08]

b) A machine costs Rs. 500.operation and maintenance costs are zero for the first year and increase by Rs. 100 every year. If money is worth 5 % every year, determine the best age at which the machine should be replaced. The resale value of the machine is negligibly small. What is the weighted average cost of owning

and operating machine? [08]

Q9) a) Repairing a certain type of machine which breaks down in given factory consists of 5 basic steps that must be performed sequentially. The time taken to perform each of the steps is found to have an exponential distribution with mean 5 minutes and is independent of other steps. If these machines break down in a Poisson fashion at an average rate of two per hour and if there is only one repairman, what is the average idle time for each machine that has broken down? [08]

b) There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing times in hours are given as

Job	:	1	2	3	4	5	6	7
Machine A	:	3	12	15	6	10	11	9
Machine B	:	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T. also find T and idle time for machines A and B.

OR

Q10) a) Customers arrive at the first class ticket counter of a theatre at the rate of 12 per hour. There is one clerk serving the customers at the rate of 30 per hour.

1) What is the probability that there is no customer in the counter?
2) What is the probability that there are more than 2 customers in counter?
3) What is the probability that there is no customer waiting to be served?
4) What is probability that customer a being served and no body is waiting? [08]

b) What is simulation? Describe its advantages in solving the problems. Give its main limitations with suitable examples. [08]

Q11) a) A civil engineering firm has to bid for the construction of a dam. The activities and their time estimates are given below.

Activity	Optimistic	Most Likely	Pessimistic
1-2	14	17	25
2-3	14	18	21
2-4	13	15	18
2-8	16	19	28
3-4 (dummy)	0	0	0
3-5	15	18	27
4-6	13	17	21
5-7 (dummy)	0	0	0
5-9	14	18	20
6-7 (dummy)	0	0	0
6-8 (dummy)	0	0	0
7-9	16	20	41
8-9	14	16	12

The policy of the firm with respect to submitting bids is to bid the minimum amount that will provide a 95 % of probability of at best breaking even. The fixed costs for the project are eight lakhs and the variable costs are 9,000 every day spent working on the project. The duration is in days and costs are in rupees.
What amount should the firm bid under this policy? [18]

OR

Q12) a) Explain The different types float. [06]

b) What is difference between PERT and CPM. [06]

c) Draw a network for the following project and number the events according to Fulkerson's rule.

A is start event and K is the end event,

A precedes event B,

J is the successor event to F,

C and D are Successor events to B,

D is the preceding event to C,

E precedes F,

C restraints the occurrence of G and G precedes H,

H precedes J and K succeeds J,

F restraints the occurrence of H. [06]

[Total No. of Questions: 12] **[Total No. of Printed Pages: 2]**

UNIVERSITY OF PUNE
[4364]-470
B. E. (MACHANICAL SANDWICH) Examination - 2013
MACHINE TOOL DESIGN [402066 B] (2008 Course)
[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

1. *Answers to the two sections should be written in separate answer-books.*
2. *Black figures to the right indicate full marks.*
3. *Neat diagrams must be drawn wherever necessary.*
4. *Use of electronic pocket calculator is allowed.*
5. *Assume suitable data, if necessary.*
6. *Answer any three questions from Section I and any three questions from Section II*

SECTION –I

Unite I

Q.1	A	Explain construction and working of Norton gear box.	10
	B	Discuss design considerations of speed regulation in cone variator.	8

OR

Q.2	A	Discuss the recent trends in Machine Tool Design with respect to a) Operating speed range b) Accuracy c) Control systems	10
	B	Explain PIV drive with block diagram	8

Unit II

Q. 3	A	Discuss design of Feed gear box in detail. Also state its features.	8
	B	State different progressions used in designing gear box with applications.	8

OR

Q. 4	A	Design a three stage 12 gear box transmitting 7.5 KW power with speed from 80 rpm to 1000 rpm. The minimum number of teeth on gear 17. Electric motor	16

		speed is 1440 rpm. Draw structural diagram and also Calculate number of teeth on gear	
Q. 5	A	Describe various methods used for compensation of wear of guides.	8
	B	Describe stick-slip sliding. Explain its remedies.	8
		OR	
Q. 6	A	What is static and dynamic stiffness? What is their effect on selection of Material for slideways?	8
	B	Discuss various types of lubrication system for beds & slideways.	8

Section -II

Unit IV

Q. 7	A	Describe working a ball recirculating power screws. Explain how preloading is carried out in ball screws	10
	B	Discuss design considerations for spindle unit of machine tool.	8
		OR	
Q. 8	A	What is the importance of power screws in machine tools? Discuss design factors to be considered while designing i) Sliding friction power screws ii) Rolling friction power screws	10
	B	Explain how the optimum spacing between spindle support is determined while designing the machine tool spindles.	8

Unit V

Q. 9	A	Explain hydraulic system used in shaper.	8
	B	Explain hydraulic system used for chuck clamping in machine tools.	8
		OR	
Q. 10	A	What is adaptive control system?	8
	B	Explain principle and working of Electric braking system in machine tools.	8

Unit VI

Q. 11	A	State and discuss design features on NC and CNC machines.	8
	B	Explain part programming of CNC machines.	8
		OR	
Q. 12	A	Discuss types of ATC (Automatic Tool Changer)	8
	B	Explain Closed loop system of CNC machine in details.	8