UNIVERSITY OF PUNE

[4364]-438

B. E. (Mechanical)

Automobile Engineering

(2008 Pattern) (Elective-II)

[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) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

SECTION-I

Q1.

a) Explain front engine rear wheel drive vehicle with help of neat sketch. Describe its advantages and disadvantages over other layouts. [8]

b) How do you classify automobiles? Explain them with the help of examples give specification of any one petrol car of your choice. [8]

OR

Q2.

a) State different types of vehicle bodies. And explain any one in detail. [8]

b) Sketch a neat layout of a four wheel drive and explain its working. [8]

Q3.

a) How you will classify clutches? Describe with neat sketch function and working of single plate clutch. [8]

b) Explain Fluid flywheel with neat sketch. [8]

OR

Q4.

a) Explain continuous variable transmission with neat sketch. [8]

b) Explain the working of a constant mesh gearbox with the help of a neat sketch. Explain its merits and demerits over sliding mesh gear box. [8]

Q5.

a) Enumerate different types of steering gears. Discuss salient features for each of them. Explain the construction and working of a rack and pinion type steering gear. [10]

b) Describe various types of stub axles with the help of suitable diagram, and state merits and demerits of each of them. [8]

OR

Q6.

a) Discuss wheel construction with neat sketch and explain any one type in detail. [10]

b) Define following. [8]

1) Cornering force.
2) Slip angle
3) Scrub radius
4) Castor

SECTION-II

Q7.

a) Explain the independent front suspension arrangement with the help of a neat sketch. State advantages of it. [10]

b) Explain a hydraulic braking system with neat sketch. [8]

OR

Q8.

a) Explain the working and construction of the shock absorber. [8]

b) Explain ABS (Antilock Braking System) in detail. Also state its advantages over hydraulic brake system. [10]

Q9.

a) Explain with neat sketch wiper mechanism. [5]

b) Explain with lay out lighting system of any typical car. [5]

c) State different types of Batteries. Explain any one with neat sketch. [6]

OR

Q10. Write short notes on any four: [16]

1) Electronic stability control
2) Sensors and actuators
3) Vehicle starting system
4) Dash board instruments
5) Traction control devices

Q11. Write short notes on any four: [16]

1) Active safety and passive safety
2) Vehicle body movements
3) Vehicle performance curves
4) Vehicle interior
5) Types of Collisions

OR

Q12.

a) Explain ergonomic consideration for vehicle. [6]

b) A truck weighs 58860 N and is powered by an engine which develops 60.311 kW at 2000 rpm. The rolling resistence is given by 0.02W, where w represent vehicle weight in N. the frontal area of the vehicle is 7.5 m^2 and the coefficient of air resistance K = 0.005, when the resistance is expressed in N and vehicle speed in km/hr. effective wheel radius = 0.35m, second gear ration = 2.5: 1 and transmission efficiency in second gear 80%. If the truck is operating at 20 km/hr in second gear and corresponding engine speed is 2000 rpm calculate:

1) Suitable rear axle ratio;
2) The tractive effort available at wheels;
3) Grade ability of truck;
4) Maximum acceleration (m/sec^2)
5) Inertia of revolving component may be neglected. [10]

UNIVERSITY OF PUNE
[4364]-440
B. E. (Mechanical)
QUANTATIVE AND DECISION MAKING TECHNIQUES(ELECTIVE II)
(2008 Course)

Total No. of Questions :12 **[Total No. of Printed Pages :5]**
[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

(1) All the questions are compulsory.
(2) Two separate answer books are used for Section I and Section II
(3) Figures to the right indicate full marks.
(4) Use of calculator is permitted
(5) Assume suitable data, if necessary.

SECTION I
UNIT I

Q1.

a) Write note on pure strategy. How it differ from mixed strategy? [6]
b) In a game of matching coins, player A wins Rs. 2. If there are two heads, win nothing if there are two tails and loses Rs. 1. When there are one head and one tail. Determine the pay off matrix, best strategies for each player and value of game to A. [12]

OR

Q2.

a) Explain following: [6]
   1) Dominance Rules
   2) Pure strategy
b) Solve the following game. Find the value of game for player A [12]

		Player B				
Player A		**1**	**2**	**3**	**4**	**5**
	1	10	81	32	43	93
	2	59	63	39	69	73
	3	71	20	5	27	84
	4	34	14	44	44	69

UNIT II

Q3.

a) Define following terms of linear programming [4]
   1) Unbounded Solution
   2) Optimum basic feasible solution

b) Solve LPP by suitable Method [12]
   Maximize:

$$\mathbf{Z=3X_1+5X_2+4X_3}$$

   Subject to:

$$\mathbf{2X_1+3X_2\leq 8}$$
$$\mathbf{2X_2+5X_3\leq 10}$$
$$\mathbf{3X_1+2X_2+4X_3\leq 15}$$
$$\mathbf{X_1, X_2, X_3 \geq 0}$$

OR

Q4.

a) Distinguish between slack, surplus and Artificial variable. [4]

b) A person requires 10,12 and 12 units of chemicals A,B and C respectively per Jar. A dry product contains 1,2 and 4 units of A,B and C per cartoon. If the liquid product sells for Rs. 3 per Jar and dry product sell for Rs. 2 per cartoon, how many of each should be purchased to minimize the cost and meet the requirements. [12]

UNIT III

Q5.

a) Describe the steps involved in Vogal Approximation Method (VAM). [4]

b) Solve the following cost-minimizing transportation problem. [12]

	I	II	III	IV	V	VI	Available
1	**2**	**1**	**3**	**3**	**2**	**5**	50
2	**3**	**2**	**2**	**4**	**3**	**4**	40
3	**3**	**5**	**4**	**2**	**4**	**1**	60
4	**4**	**2**	**2**	**1**	**2**	**2**	30
Required	30	50	20	40	30	10	180

OR

Q6.

a) What is the unbalanced assignment problem? How is it solved by the Hungarian method? [6]

b) Four different jobs are to be done on four different machines. Table below indicate the cost of producing job I on machine j in rupees. Solve the problem assuming that the objective is to minimize the total cost. [10]

Machines

Jobs		1	2	3	4
	1	**5**	**7**	**11**	**6**
	2	**8**	**5**	**9**	**6**
	3	**4**	**7**	**10**	**7**
	4	**10**	**4**	**8**	**3**

SECTION-II

UNIT IV

Q7.

a) Explain the following with reference to queuing models: [6]
   1) M/M/1
   2) Traffic intensity
   3) Service discipline

b) A manufacturing company purchases 9000 parts of a machine for its annual requirement, ordering one month usage at a time. Each part costs Rs. 20. The ordering cost per order is Rs.15 and carrying charges are 15% of the average inventory per year. You have been assigned to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year? [10]

OR

Q8.

a) What is meant by Monte Carlo method of simulation? Discuss its applications [6]

b) In a railway marshalling yard, good's trains arrive at rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 min. Calculate the following [10]
   1) The mean queue size
   2) The probability that the queue size exceeds 10.
   3) If the input trains increase to an average 33 per day, what will be the change in 1) and 2)

UNIT V

Q9.

a) Explain Average (Accounting) Rate of return of method with its Merits and Demerits. [6]

b) ABC corporation has given the following information on its capacity, sales and cost as follows: [10]

Current capacity :100000units

At current level of operations, its margin of safety is 5 percent of its break-even point

Contribution Margin P/V ration : 2.5 percent

The unutilized capacity at present is : 10000 units

Sales prize : Rs.40 per unit

Determine:

1) Breakdown point in sales volume
2) Fixed cost
3) Variable cost per unit
4) Margin of safety in units
5) If the fixed cost is decreased by Rs. 1, 80,000 to what extents can the price be reduced to maintain the total profit at current level.

OR

Q10.

a) What is payback period? How it differ from other methods? Explain with appropriate example [6]

b) A manufacture is offered two machines A and B. A is priced at Rs. 5000 and running cost are estimated at Rs. 800 for each of the first five years, increasing by Rs. 200 per year in the sixth and subsequent years. Machine B, which has the same capacity as A, cost Rs.2500 but will have running cost of Rs.1200 per year for six years, increasing by Rs.200 per year thereafter. If money is worth 12% per year, which machine should be purchased? (Assume that the machines will eventually be sold for scrap at negligible price). [10]

Q11.

a) Discuss all types of floats. Discuss their importance. [6]

b) The table below gives precedence relationships and the duration of various activities: [12]

Activity	Predecessor activity	Duration (days)		
		t_O	t_m	t_p
A	-	6	10	12
B	-	7	10	12
C	A	20	22	25
D	B	14	15	17
E	A	10	12	15
F	C,D	10	12	14
G	B	12	14	18
H	E	16	18	21
I	C,D,G	12	14	17
J	E	1	2	3
K	F,H,I	7	9	11
L	C,D,G	17	19	22
M	J	7	8	10

Based on the above table draw PERT network, number of events using Fulkerson's rule and identity the critical path using expected duration of the project.

OR

Q12.

a) Differentiate between CPM and PERT [6]

b) Calculate EST and LFT, total float, project duration and show Critical path on the network using following information [12]

Activity	Durations (Days)	Activity	Duration (Days)
1-2	3	3-5	4
1-3	4	3-6	6
1-4	14	4-5	1
2-3	10	5-6	1
2-6	5		

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

UNIVERSITY OF PUNE

[4364]-445

B. E. (Mechanical) Part II Examination - 2013

402049C ROBOTICS (2008 Course)

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

Instructions:

1 *Answer 3 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 *Use of electronic pocket calculator and steam tables is allowed.*
6 *Assume suitable data, if necessary.*

SECTION -I

Q.1	A	Describe various characteristics used to specify Industrial Robot.	8
	B	Define and Explain a. Stability b. Compliance c. Control resolution d. Spatial resolution	8

OR

Q.2	A	In a Robot, a twisting joint Wrist assembly can rotate through 10 full revolutions and is required to have a resolution of 0.2°. Find out the required bit storage capacity for achieving this resolution.	8
	B	Explain the term "Compliance" in terms of a robot? Explain types of Compliance.	8
Q. 3	A	Classify various types of grippers used in Industrial Robots. Describe vacuum type of gripper in detail.	8
	B	With neat sketch explain proximity sensor used in Robot.	8

OR

Q. 4	A	Explain the Design considerations of gripper selection.	8
	B	With neat sketch explain range sensor used in Robot.	8
Q. 5	A	Explain different types of controllers used in industrial robots.	8
	B	The second joint of the SCARA manipulator is required to move from a_2=30° to 150° in 5 sec. find the cubic polynomial to generate smooth trajectory of the joint. What is the maximum velocity possible for this trajectory?	10

OR

Q. 6	A	Explain different types of actuators used in industrial robots.	10
	B	Explain control Law of partitioning	8

SECTION II

Q. 7	A	{UVW} is obtained from {XYZ} by rotation of 90° about Z axis	10

		followed by rotation of 90° about X axis. Then {UVW} locates a point P at U = 20, V = 30 and W = 40. Determine its coordinates with respect to {XYZ}	
	B	With the help of suitable illustration, explain the difference between Forward and Inverse Kinematics.	8
		OR	
Q. 8	A	First joint of a 3R robot is to rotate from 20° to 65° in 5 sec. determine the linear trajectory and its rotation after 3 sec.	6
	B	Write short notes on: 1) D-H parameters, 2) Kinematic Redundancy	12
Q. 9	A	What is the need of 'Vision System' in a Robot? Classify the Robotic Vision Systems.	8
	B	Explain and compare different methods of 'Robot Programming'	8
		OR	
Q. 10	A	Write a short note on 'Image Processing Techniques'	8
	B	State different Robot Languages & Discuss them in brief.	8
Q. 11	A	Write a short note on 'Artificial Intelligence'	8
	B	What is the International Scenario for implementing robots in Industrial and other sectors?	8
		OR	
Q. 12	A	Write a short note on 'Need of simulation in Robotics'	8
	B	What are Economical aspects for robot design?	8

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

UNIVERSITY OF PUNE

[4364]-452

B. E. (Mechanical)-II Examination - 2013

INDUSTRIAL AUTOMATION (Open Elective)(2008 Course)

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

Instructions:

1 Answer three question 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 Assume suitable data, if necessary.

SECTION -I

Q.1	A	Define Feedback and Feed Forward control systems w.r.t block diagram and appropriate example of each.	8
	B	Compare Mechanization and Automation and explain benefits of Automation	8

OR

Q.2	A	Explain the terms transmitter & converter with two examples.	12
	B	Explain PLC as an automation tool with respect to two applications in Industry.	4
Q. 3	A	Draw the Block diagram of PLC and explain types of inputs, Outputs, used in PLC applications.	8
	B	In an industrial mixer following operations are to be carried out sequentially. Develop a ladder diagram. i) The process is put ON by the START button (Push-to-ON) and continue to be on till STOP (Push-to-OFF) button is pushed. ii) Liquid is to be filled with pump till the level high float switch is ON iii) The liquid is to be heated till 400°C (sensed by Temperature switch set at 400°C) iv) The heater is put off v) Then liquid is to be stirred for next 10 minutes vi) The outlet valve opens and liquid is drained till Level Low float switch is off vii) The process stops and to be restarted by START button	10

OR

Q. 4	A	Write the importance of DCS in automation. Explain the hierarchical evolution and functional distribution of DCS	8
	B	Develop a ladder diagram for the following automatic drilling process,	10

i) The process is put ON by the START button (Push-to-ON) and continue to be on till STOP (Push-to-OFF) button is pushed.
ii) The presence of clamped work-piece by proximity sensor (P1)
iii) The drill spindle (solenoid actuator M1) is moved towards work-piece
iv) Start drilling when drill reaches the work-pieces and will be stopped when proximity switch (P2) is ON ensuring required depth reached.
v) Retract the drill (solenoid actuator M2) and then it is switch off
vi) The cycle will be repeated after next clamped work-piece is in sensed in position.

Q. 5	A	Compare CNC and DNC and explain its advantages of DNC in brief.	8
	B	What is FMS? Explain with block diagram of a suitable example.	8
		OR	
Q. 6	A	Compare FMS and CIMS.	8
	B	Explain with neat sketch Tool Management System in FMS	8

SECTION I

Q. 7	A	Explain roll of common system components of SCADA.	9
	B	Compare SCADA system with HMIs used in Industrial Automation.	9
		OR	
Q. 8	A	Explain in brief features and configuration of HMI system.	9
	B	Draw the block diagram of SADA and explain the function of each of block	9
Q. 9	A	Explain Geneva Mechanism and Rotary table mechanism in brief.	8
	B	Compare induction and Stepper Motor.	8
		OR	
Q. 10	A	Explain principle and working of BLDC used to control the speed of electric motors	8
	B	Explain two applications of pneumatic circuits used in industrial automation with working and advantage over manual method of doing the same task.	8
Q. 11	A	Explain Automation in Material loading and Unloading	8
	B	Discuss in brief Remote Centre Compliance	8
		OR	
Q. 12	A	Explain automation in drilling machine with respect to process logic, objectives, inputs, outputs, write all assumptions clearly.	8
	B	Discuss use of automation with respect to conveyor belts such as used in Cement or Sugar industry	8

UNIVERSITY OF PUNE
[4364]-433
B. E. Examination - 2013
Industrial Fluid Power
(2008 Pattern)

Total No. of Questions : 12 **[Total No. of Printed Pages :4]**

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

Instructions :

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

SECTION-1

Q. 1. a) Explain different types of hydraulic fluids. (8)

b) What are different types of filters used in hydraulic system? (8)

OR

Q. 2. a) Explain types of seals used in hydraulic system. What are different materials used? (8)

b) Draw a neat sketch of hydraulic reservoir & explain the types of hydraulic reservoir. (8)

Q. 3. a) Explain with a neat sketch the working of in line piston pump. State its applications (8)

b) The displacement of a pump operating at 1000 rpm at a pressure of 70 bar is 100cm^3. The input at torque is 120 N-m, If the pump delivers 0.0015 m^3/s of oil. (8)

Find

i. Overall efficiency of pump
ii. Theoretical torque

iii. Volumetric efficiency

OR

Q. 4. a) Explain different types of mountings of a hydraulic cylinder (8)

b) An accumulator has ram 0.3m and 6m lift and is loaded with 800kN total load. It the packing friction is equivalent to 5% of load on ram, find the power delivered to the machine if the ram falls its full range in 90sec. at the same time pump is discharging 30 lps. Of fluid. (8)

Q. 5. a) Explain different methods of speed control . (10)

b) Draw symbols for (8)

1) Sequence value 2) Cushioned cylinder 3) Double acting pressure – intensifier 4) Unloading valve 5) Reversible motor 6) Pilot operated pressure reducing valve 7) Accumulator 8) Hose

OR

Q. 6. a) Explain (10)

i. Proportional valve

ii. Servo-valve

b) Explain cartridge valve & its application (8)

SECTION-2

Q. 7. a) A hydro static transmission operating at 105 bar has the following (10)

$pump$	$Motor$
VD_2 100 cm^3	VD =?
$N = 1000rpm$	$N = 600rpm$
n_v =?	$n_v = 94\%$
n_m =?	$n_m = 92\%$

Find 1) Displacement of motor 2) motor output torque

b) Explain with a neat sketch the working of balanced vane motor (8)

OR

Q. 8. a) Draw unloading circuit of a pump & explain its working (9)

b) Draw a hydraulic circuit using intensifier for punching operation. (9)

Q. 9. a) Explain the working of FRL used in pneumatic motor. (8)

b) Draw an explain the speed control of a pneumatic motor. (8)

OR

Q. 10. a) Explain with a neat sketch the working of shuttle value with a typical application. (8)

b) Explain the working of time delay valve with a typical application. (8)

Q. 11. a) Sequential operations of two pneumatic cylinders are required as Follows. (16)

1) Cylinder A extends 2) Cylinder B extends 3) Cylinder B retracts

4) Cylinder A retracts

Develop pneumatic circuit using pilot operated 4/2 D.V.C. and roller operated valves.

Q.12. Two identical cylinders A & B are to be operated simultaneously. The cylinder A moves again a load of 25 uN, while the cylinder B moves against a load of 20 kN. Both the cylinders have stroke of 1m. the working stroke has to be completed in 20 seconds. The return stroke of cylinder B is to start only after the cylinder A is completely retracted. The return speeds are to be fast as possible Draw a circuit which full fill these requirements Select the different components you have used in the circuit from the given data. (16)

DATA

1. Suction Strainer :

2. Pressure Gauge :

Model	Range (bar)
PG_1	0-25
PG_2	0-4
PG_3	0-100
PG_4	0-160

Model	Flow capacity(/pm)
s_1	38
s_2	76
s_3	152

3. Vane Pump

Model	Delivery in/pm		
	At 0bar	At 35 bar	At70 bar
P_1	8.5	7.1	5.3
P_2	12.9	11.4	9.5
P_3	17.6	16.1	14.3
P_4	25.1	23.8	22.4
P_5	39.0	37.5	35.6

4. Relief Valve

Model	Flow capacity (/pm)	Max working pressure & bar
R_1	14.4	70
R_2	19	210
R_3	30.4	70
R_4	57	105

5. Flow control valve

Model	Working pressure (bar)	Flow range (/pm)
f_1	70	0-4.1
f_2	105	0-4.9
f_3	105	0-16.3
f_4	70	0-21.6

6. Directional Control Valve

Model	Max working pressure (bar)	Flow capacity (/pm)
D_1	350	19
D_2	210	38
D_3	210	75

7.Check Valve

Model	Max	Flow

8.Pilot Operated Check Valve

	working (bar)	capacity (/pm)
C_1	210	15.2
C_2	210	30.4
C_3	210	76

Model	Max working pressure (bar)	Flow capacity (/pm)
PO_1	210	19
PO_2	210	38
PO_3	210	76

9. Cylinder (Max Working Pressure 210 bar)

Model	Bore dis (mm)	Rod dis (mm)
A_1	25	12.5
A_2	40	16
A_3	50	35
A_4	75	45
A_5	100	50

10.Oil Reservoirs

Model	Capacity (litres)
T_1	40
T_2	100
T_3	250
T_4	400
T_5	600

UNIVERSITY OF PUNE

[4364]-434

B.E. (MECHANICAL) 2008 course

ENERGY AUDIT MANAGEMENT

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

Instructions:

(1) Figures to the right indicate full marks.
(2) Solve questions 1 or 2,3 or 4,5 or 6 from section 1 and 7 or 8,9 or 10,11 or 12 from section 2.
(3) Answer to the two sections should be written in separate books.
(4) Neat diagrams must be drawn wherever necessary.
(5) Use of logarithmic tables, slide rule, Molliercharts, electronic pocket calculator and steam tables is allowed.
(6) Assume suitable data, if necessary.

SECTION-1

Q. 1. A) Discuss different aspects of Energy Policy and strategy in energy conservation systems. (8)

B) Explain Energy consumption pattern of global and Indian industry. (8)

OR

Q. 2. A) Write the responsibilities of energy auditor. (8)

B) Write short notes on (8)

1) Energy Policy 2) Energy action planning

Q. 3. A) What is the need of energy audit? What are the areas that need to be focused during pre-audit phase?. (8)

B) What are the energy conservation opportunities is Refrigeration and HVAC systems? (8)

OR

Q. 4. A) Explain Energy Audit Methodology for Ice factory? (8)

B) Explain the following instruments used for energy audit with their applications (8)

1. Pitot tube
2. Ultrasonic flow meter.

Q.5. A) Explain following financial analysis methods. (10)

1. Return on Investment
2. Simple Payback period.

B) Calculate Net present Value of a project at a discount rate of 12% (8)
With an investment of Rs. 60,000 at the beginning of the first year, & Saving of Rs. 28,000 & Rs. 41,000 at the end of the first & second year Respectively

Q.6. A) What is Sensitivity Analysis? List different factors considered for Sensitivity Analysis. (8)

B) A sum of Rs. 40,000 is deposited in a bank at the beginning of a year. (6)
The bank pays 8% interest annually. How much money is in the bank Account at the end of the fifth year, if no money withdrawn?

C) Explain IRR its advantage and Disadvantage (4)

SECTION-2

Q. 7. A) Calculate the efficiency of the boiler by direct method with the data given below: (10)

i. Type of boiler: Oil fired
ii. Quantity of dry and saturated steam generated :6800 kg/hr
iii. Quantity of fuel consumed :495 kg/hr
iv. Steam pressure and temperature : $10kg/m^2\ and\ 180C^{\circ}$
v. Feed water temperature : 70˚C
vi. Gross Calorific Value of oil : 43900kJ/kg
vii. Enthalpy of saturated steam at $10kg/m^2\ and\ 180^{\circ}C : 26776kJ/kg$
viii. Enthalpy of feed water =320kJ/Kg.

B) What is the trap? List the types of steam trap and explain thermodynamic steam trap. (8)

OR

Q.8. A) Explain the energy saving opportunities in compressed air system. (10)

B) What are the measures to be taken for efficient operation of HV AC Systems.

Q. 9. A) The connected load for the hostel are as below. (8)

a. 190 Fluorescent tubes of 55W each with magnetic ballast
b. 20 Fluorescent tubes of 40 W each with electronic ballast
c. 20 old fan of 100W each

It is decide to replace the all tubes of 20 W. And old fan by new fan of 80W. considering usage of 06 hours per day and an electrical tariff of Rs. 4per KWh. Calculate energy saving of tubes and fans replacement

B) Explain why efficiency of Energy Efficient Motor is more than Conventional motor? (8)

Q. 10. A) Define and explain power factor (PF). How PF is improved. List the benefits of PF improvement. (8)

B) What are the types of lamps used in lighting system? Write down Their features with typical application. (8)

Q. 11. A) What is the cogeneration? Describe technical option for Cogeneration and write down advantage of cogeneration. (8)

B) classify the waste heat recovery with example. Write down Benefits. (8)

Q. 12. A) Compare topping cycle and bottoming cycle of cogeneration with Example. (8)

B) Describe heat wheel used for waste heat recovery with neat Sketch. (8)

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]

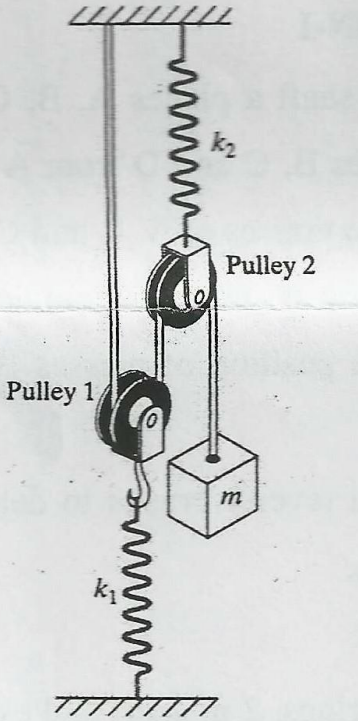


Fig. 1

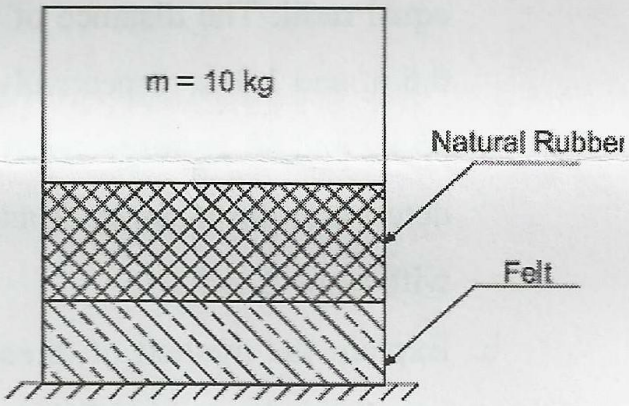


Fig. 2

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

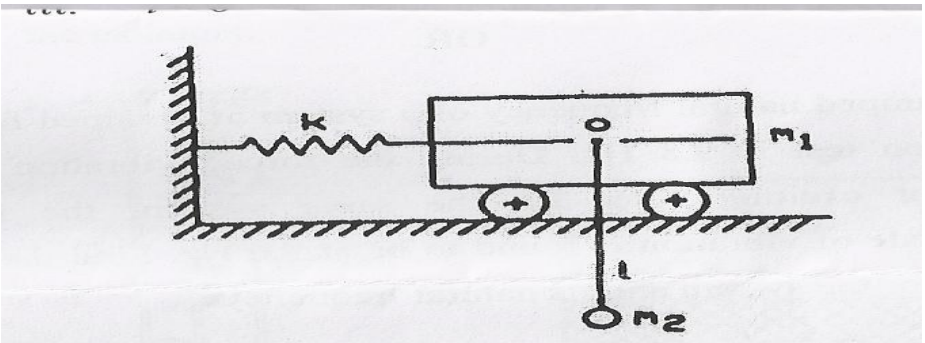


Fig. 3

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]

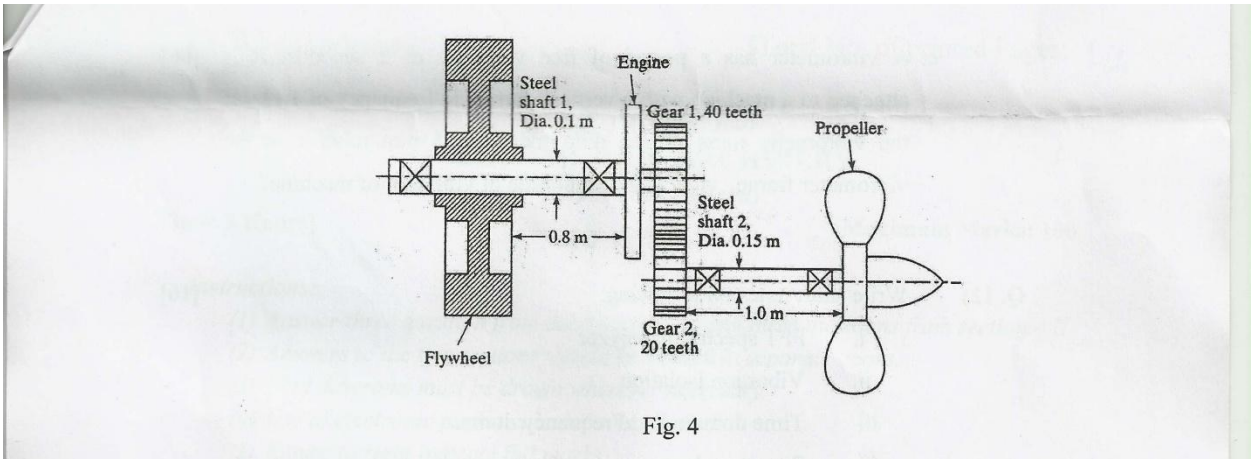


Fig. 4

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

[4364]-431

B. E. (Mechanical Eng.) Examination - 2013

CAD-CAM & AUTOMATION

(2008 Course)

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

Instructions :

(1) Answer Q. No.1 OR 2, No.3 OR 4, No.5 OR .6 No.7 OR 8, Q.No.9 OR 10, No.11 OR 12

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

(3) Neat diagrams must be drawn wherever necessary.

(4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(5) Assume suitable data, if necessary.

SECTION-I

Q1. a) Explain reflection of geometrical entity about line y =m•x +c, with schematic representation and write concatenated transformation matrix. [08]

b) Find concatenated matrix if the transformations are performed as per the following sequence. [10]

i) Rotation through 45^0 anticlockwise.

ii) Translation through +5 and -8 units along the x and y directions.

iii) Rotation through 60^0 clockwise.

What is the effect of above transformations on triangle having co-ordinates A(0,0) B(10,0) and C(0,8).

OR

Q2. a) Compare Geometrical transformation and mapping. [04]

b) Write OPEN GL command for vertex, Color, Scale and translate. [04]

c) A tetrahedron is defined by the following points A(2,3,4,) B(6,3,4) C(2,5,4) and D(4,4,10) with a transformation matrix generate data for the orthographic view of the object in viewing plane. [08]

Q3. a) Explain non parametric and parametric curves. Compare its mathematical formulations for circle and advantages of parametric representation of circle. [06]

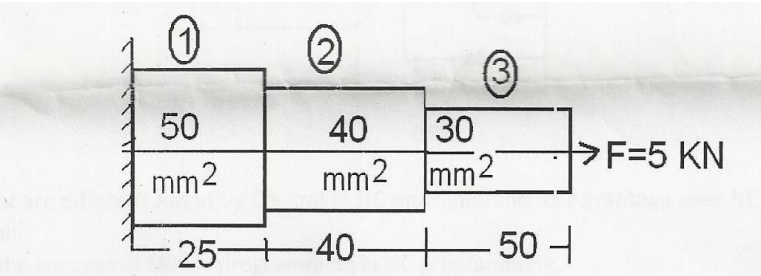
b) A circle is represented by center point (5,5) and radius 7 units. Find parametric equation of circle by recursive method and determine the various points on the circle in first quadrant if increment of angle is 15^0. [10]

OR

Q4. a) Plot the hermit cubic spline curve for the points at the value of u=0, 0.2, 0.4,0.6, 0.8, and 1 having the end points P0 (1,1) and P1 (7,4). The tangent vector for end P0 is defined by the line between P0 and another point P2 (8,7) whereas the tangent vector for end P1 is defined by the line between P1 and point P2 (8,7). [10]

b) Explain CSG method of solid modeling with the example of any mechanical component. [06]

Q5. a) An axial step bar is shown in figure. It is subjected to axial pull of 5 kN. If material of bar is uniform and having a modulus of elasticity as 200 GPa. Determine deflection and stresses in each element and reaction force. [12]



b) Explain the concept of shape function for 1 – D element. [04]

OR

Q6. a) Derive the element stiffness matrix and stress vector for truss element. [08]

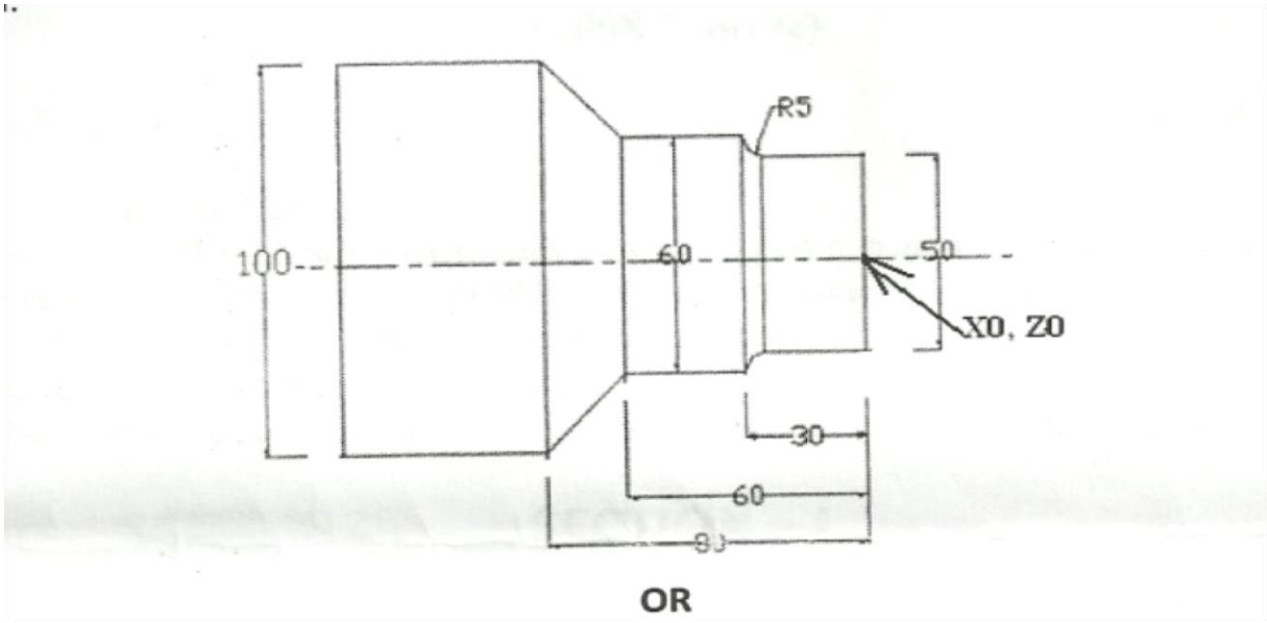
b) Explain plane stress and plane strain with suitable examples. [08]

SECTION –II

Q7. a) Explain fixed Zero and floating zero for CNC machine. [04]

b) Explain G00, G01, G02 and M03 codes in part programming. [04]

c) Write a CNC part program to take a finish cut for the shape shown in the figure. Assume suitable machining data. [10]



OR

OR

Q8. a) What are different Adaptive Control in NC machines and its advantage over NC system. Explain any one in detail. [08]

b) Explain the concept of mirror programming in NC programming. [04]

c) Explain Canned cycle for drilling and tapping. [06]

Q9. a) Compare various types of automation. [08]

b) Explain Group technology layout with appropriate figure. [08]

OR

Q10. a) Explain Machining center. [08]

b) What are the various elements of Flexible Manufacturing system? [08]

Q11. a) Explain the various joints used in Robot. [08]

b) Explain Articulated configuration robot with application and draw its work envelope. [08]

OR

Q12. a) Write short note on teach pendant method of programming [06]

b) Compare types of actuators used in robot. Explain stepper motor as an actuator for driving robot joint. [10]

UNIVERSITY OF PUNE

[4364]-435

B. E. Mechanical Semester -I Examination -2013

PRODUCT DESIGN & DEVELOPMENT

(402044-B) (Elective I)

(Course 2008)

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

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

Instructions :

1) *Answer **any three** questions from each I and three questions from section II*

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

3) *Neat diagrams must be drawn wherever necessary.*

4) *Black figures to the right indicate full marks.*

SECTION – I

Q.1 a) Explain design by innovation & design by evolution in detail [8]

b) Explain the concept of standardization & simplification in product design [8]

OR

Q.2 a) Discuss product design versus product development [8]

b) Explain product development team functions in detail [8]

UNIT – II

Q.3 a) Explain technology s-curve & technology Forecasting? [8]

b) Discuss the concept of market segmentation [9]

OR

Q.4 a) What are different types of customer needs? Explain various need gathering methods [17]

UNIT – III

Q.5 a) Elaborate in detail pughs concept selection [8]

b) Explain Fast Method with suitable example [9]

Q.6 a) Explain the concept of augmentation & Aggregation in the light of product design [8]

b) Discuss failure Modes & Effect Analysis with suitable example. [9]

SECTION – II

UNIT – IV

Q.7 7) Explain the detailed procedure of product teardown with force flow diagrams. [16]

Q.8 a) Explain function based modularity & manufacturing based modularity for a product. [8]

b) Discuss intended Assembly cost analysis [8]

UNIT – V

Q.9 a) Discuss various guidelines for design for environment [8]

b) Explain the concept of Piece – Part Production [9]

OR

Q.10 a) Discuss weighted sum assessment method for life cycle assessment [8]

b) Discuss local & regional issues of environment pollution [9]

UNIT – VI

Q.11 a) Explain the emergence of PLM [8]

b) Discuss product Data & product workflow in detail [9]

OR

Q.12 a) Explain product life cycle with suitable example [8]

b) Explain the significance of PLM in globalized competitive scenario [9]

[4364]-436

B. E. (Mech) Examination - 2013

DESIGN OF PUMPS BLOWERS AND COMPRESSORS (ELECTIVE I)

(2008 Pattern)

Total No. of Questions : 12 **[Total No. of Printed Pages :4]**

[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) Assume suitable data, if necessary.

SECTION-I

Q1 a) Explain the following terms. [10]

i) Flow Machines ii) Turbines iii) Pumps iv) Compressible Flow Machines

v) Incompressible Flow Machines

b) A turbo blower develops 750 mm W.G. at a speed of 1480 rpm and a flow [8] rate of $38 m^3$/s. It is desired to build a small model which develops the same head at a higher speed (2490 rpm) and low discharge. Determine the specific speed and the flow rate through the model.

OR

Q2 a) Derive the basic equation of energy for the flow machines. Define [10] stagnation state and derive equations for i) stagnation enthalpy, ii) stagnation temperature, iii) stagnation velocity of sound, iv) stagnation pressure and v) stagnation density.

b) Explain the performance characteristics of pumps, compressors, fans and [8] blowers.

Q3 a) The axis of a centrifugal pump is 2.5 m above water level in the sump [8] and the static lift from the pump centre is 33.5 m. The friction losses in the suction and the delivery pipes are 1 m and 7.5 m respectively. The suction and delivery

pipes each are 75 mm diameter. The impeller is 300 mm diameter and 18 mm wide at outlet and its speed is 1700 rpm. The water at inlet has radial flow and the vane angle at outlet and is 32° to the tangent to the periphery. Compute the discharge of the pump and the power required to drive the pump. Assume η_{mano} = 77% and η_o = 72%.

b) Explain different efficiencies of centrifugal pump. [8]

OR

Q4 a) Find the overall efficiency of a centrifugal pump which delivers 50 lit/s of water to a height of 10 m through 140 mm diameter and 100 m long pipeline. The Darcy's f= 0.05 for pipeline. Assume inlet losses in suction pipe equal to 0.33m and power required to drive the centrifugal pump is 20 kW. [8]

b) Write a short note on; i) Different types of Losses in pumps ii) Cavitations in centrifugal pump. [8]

Q5 a) Explain the following terms [8]

i) Static Suction Head

ii) Static Suction Head

iii) Static Discharge Head

iv) Total Static Head

b) Explain general design considerations of pump casing. [8]

OR

Q6 a) Write a note on pump performance due to wrong estimation of system head. [8]

b) Explain various forms of corrosion occurred in hydraulic machines [8]

SECTION-II

Q7 a) A fan has the following data: [10]

Speed, N= 1400 rpm

Pressure rise,Δp = 5 cm of W.G.

Air flow rate, Q= 1.5 m^3/s

Efficiency, η = 78%

Inlet pressure, P_1=1.0 bar

Inlet temperature, T_1=290 K.

i) Calculate the power required to drive this fan.

ii) If this fan is taken to a high altitude place where the state of air at fan inlet is P=0.898 bar, T=282 K. What is the Fan i) speed ii) volume flow rate iii) the power required for the same pressure rise.

b) Explain the different applications of compressors, fans and blowers. [8]

OR

Q8 a) Explain functions of an airfoil and discuss the characteristic curves of airfoils. [8]

b) Derive the following relations for an axial compressor stage with constant axial velocity [10]

$$\Psi = \phi(\tan\beta_1 - \tan\beta_2)$$

$$\tan\alpha_1 + \tan\beta_1 = \tan\alpha_2 + \tan\beta_2 = \frac{u}{v_x}$$

Q9 a) Explain functions of an airfoil and discuss the characteristic curves of airfoils. [8]

b) What are the main causes of noise generation? What are the methods of reducing fan noise? [8]

OR

Q10 a) Explain briefly what is the purpose of inlet guide vanes and inducer blades. Why is the radial-tipped impeller most used in centrifugal compressor stages? [8]

b) What is surging? What are its effects? What is stalling? How it is developed? [8]

Q11 a) What is the work done factor for an axial compressor stage? How does it vary with the number of stages? [8]

b) Prove the following for isentropic flow in a radial-tipped impeller: [8]

$\Psi=1$

$$P_{r\varpi} = 1+\left(\frac{u_2^2}{c_p T_{01}}\right)^{\frac{y}{y-1}}$$

OR

Q12 a) An axial compressor stage has the following data: [12]

Temperature and pressure at entry 300K, 1 bar

Degree of reaction	50%
Mean blade ring diameter	36 cm
Rotational speed	18000 rpm

Blade height at entry	6 cm
Air angle at rotor and stator exit	25°
Flow coefficient	0.53
Work-done factor	0.88
Stage efficiency	85%
Mechanical efficiency	96.7%

Determine a) Air angles at rotor and stator entry b) the mass flow rate of air c) the power required to drive the compressor d) the loading coefficient e) the pressure ratio developed f) the Mach number at stator entry.

b) Explain briefly what is the purpose of inlet guide vanes and inducer blades.[4]

UNIVERSITY OF PUNE

[4364-437]

B.E. (Mechanical) Examination-2013

Tribology(Elective-I)

(2008 pattern)

Time-Three hours Maximum Marks-100

Total No. of Question=12 [Total no. of printed pages= 3]

Instructions:

(1)*Section I :Q1or Q2, Q3 or Q4, Q5 or Q6Section II: Q7 or Q8, Q9 or Q10, Q11 or Q12*

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

(3)Neat diagrams must be drawn whenever necessary.

(4)Figures to the right indicate full marks.

(5)Assume suitable data wherever necessary.

SECTION-I

Q.1

(a)Explain in short the following terms of lubrication. (8)

(i)SUS (ii)Viscosity Index

(iii)Kinematic Viscosity (iv)Absolute Viscosity

(b)Write a short note on (i)Types and uses of greases (ii)Factors influencing the selection of lubricants. (8)

OR

Q.2

(a)Explain the importance of 'Tribology'in design of different machine elements. (8)

(b)Explain any four types of additives used in lubricating oils. (8)

Q.3

(a)Explain any two theories of friction (8)

(b)Write a note on friction measurement by pin-on-disk apparatus.Also explain the causes of friction. (8)

OR

Q.4

(a)Write notes on- (8)

(1)Adhesive wear (2)Abrasive wear (3)Fretting wear (4)Corrosive wear.

(b)Explain (1)Archard's wear theory (3)Factors affecting wear (8)

Q.5

(a)Derive two-dimensional Reynold's equation for Hydrodynamic lubrication with usual notations. Also state the assumptions. (12)

(b)What do understand by infinitely long journal bearing and Infinitely short journal bearing.Comment on pressure gradient and load carrying capacity in both cases. (6)

OR

Q.6

(a)Name the types of Hydrodynamic thrust bearing. Derive the equations for pressure distribution and load carrying capacity for flat plate thrust bearing. (10)

(b)The following data is given for 360^0 hydrodynamic bearing.(Refer Table 1)

Radical Load=5 KN
Journal speed=1000rpm
l/d ratio=1
Bearing length(l)=50 mm
Radical clearance(c)=20 microns
eccentricity(e)=16 microns

Calculate:i)Minimum oil film thickness ii)coefficient of friction iii)power lost in friction iv)Viscosity of lubricant in cP. (8)

Table 1:

$\frac{l}{d}$	$\frac{h_0}{c}$	Є	S	$\left(\frac{r}{c}\right)f$	$\frac{Q}{rcn_s l}$	$\frac{Q_s}{Q}$	$\frac{Pmax}{P}$
1.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000
	0.0300	0.9700	0.00474	0.5140	4.8200	0.973	6.579
	0.1000	0.9000	0.0188	1.0500	4.7400	0.919	4.048
	0.2000	0.8000	0.0466	1.7000	4.6200	0.842	3.195
	0.4000	0.6000	0.1210	3.2200	4.3300	0.680	2.409
	0.6000	0.4000	0.2640	5.7900	3.9900	0.497	2.066
	0.8000	0.2000	0.6310	12.8000	3.5900	0.280	1.890
	0.9000	0.1000	1.3300	26.4000	3.3700	0.150	1.852
	1.0000	0.0000	∞	∞	3.1420	0.0000	0.0000

SECTION-II

Q.7

(a)Give advantages and limitations of Hydrodynamic bearings. (6)

(b)Derive expression for flow rate through rectangular slot. Also state the assumptions while deriving the equation. (10)

OR

Q.8

(a)Explain with sketch the arrangement of different accessories in hydrostatic lubrication system. (6)

(b)A circular plate of 50 mm radius is approaching the base plane at velocity of 150mm/s at the instant when oil film thickness is 0.2mm.If the Viscosity of the oil is $0.025\times10^{-6}\,N-s/m^2$,calculate (i)Load carrying capacity (ii)Maximum pressure (iii)Average pressure. (10)

Q.9

(a)Write on note-1)Desirable properties of bearing materials (12)
2)Types of gaskets 3) Oil seals

(b)Explain the principle of Elastohydrodynamic lubrication. State the applications. (6)

OR

Q.10

(a)Write note on:1)Lubrication in Rolling 2)Lubrication in Extrusion
3)Lubrication in Drawing (12)

(b)Write the merits ,demerits of Gas lubrication. (6)

Q.11

(a)Explain the concept and scope of Surface Engineering. (4)

(b)Write short notes on:-1)Diffusion 2)Hot dip coating 3)Metal Spraying(12)

OR

Q.12

(a)Explain the general characteristics of superficial layers obtained by matching,strengthening and weakening of superficial layers. (8)

(b)Write notes on -1)Cladded coating 2)Crystalling Coating. (8)

UNIVERSITY OF PUNE
[4364]-439
B. E. (Mech) Examination 2013
MACHINE TOOL DESIGN
(2008 Course)(402045B)

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

Instructions :

(1) *Answers to the two Sections should be written in separate answer-books*
(2) *Use of mobile and other electronic gadgets are not allowed*
(3) Figures to the right indicate full marks.
(4) Assume suitable data, if necessary.
(5) Use of non-programmable pocket calculator is allowed

SECTION –I

Q.1a) List the machining operations requiring intermittent power and explain the drive design to meet this requirement. [8]

b) Explain why geometric progression is used in machine tool drive speed regulation. [8]

OR

Q.2a) List the objectives of speed regulation and explain the laws of stepped regulation of speed [16]

Q.3a) Explain the factors affecting machine tool stiffness and methods of improving it. [16]

OR

Q.4 What is dynamic stiffness of machine tool, explain the factors on which it depends with suitable mathematical expressions [16]

Q.5a) Explain functions and types of guide ways [8]

b) Explain stick-slip motion in sideways [10]

OR

Q.6a) Explain design criteria for slide-ways [8]

b) Compare various types of slide-ways and state their application [10]

SECTION- II

Q.7a) What are the requirements of machine tool spindle [4]

b) Describe with a neat sketch spindle unit of a milling machine (Horizontal) also show arrangements for power input to the spindle and for power output to the arbour [8]

c) Discus in details how optimization of spacing between spindle supports is achieved [6]

OR

Q.8a) Explain why the distribution of load over the threads is more uniform in a ball lead screw in comparison to sliding friction lead screw [6]

b) Show that the total error in a pitch of a lead screw is given by [12]

Error $\Delta = \frac{Q.P}{E.A}\left[1 + \frac{P^2}{D^2.2\eta}\right]$

Where Q-Axial load on screw [12]

P-Pitch of screw

E-Young's modulus of elasticity of screw material

A-core area of screw

η-Transmission efficiency of screw

Q.9a) Explain and draw the control circuit diagrams for [16]

i) Push button control

ii) Thermal relay and

iii) Electrical braking system

OR

Q.10a) Explain Adaptive control of machine tools [8]

b) Explain various dynamic characteristics for the cutting process [8]

Q.11a) Explain retrofitting with reference to an old lathe unit [8]

b) Explain with block diagram the principles of operation of a CNC machining center [8]

OR

Q.12a) Explain design considerations for stepless drives [6]

b) With neat sketch, explain the principle of obtaining stepless speed variation in a variator with epicyclic mechanism [10]

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *4*]

UNIVERSITY OF PUNE

[4364]-441

B. E. (*Mechanical Engineering***) Examination - 2013**

Power Plant Engineering (2008 Course)

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

Instructions:

1 *Answers 3 Que. From section I and 3 Que. From section II*
2 *Black figures to the right indicate full marks.*
3 *Neat diagrams must be drawn wherever necessary.*
4 *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
5 *Assume suitable data, if necessary.*

SECTION –I

Unit I

Q.1 A Write short notes on any two 10

1. Load Shedding
2. Role of NTPC
3. Carbon credits and its implications clean technology.

B Find the generation cost of a 20MW power station from the following data. 06

Capital cost-Rs. 60×10^6
Annual cost of fuel- Rs. 6×10^6
Annual wages and taxes- Rs. 8×10^6
Interest and depreciation- 18%
Annual load factor- 50%

OR

Q.2 A Compare the steam, hydro, gas and diesel power plant on the basis of site, cost, reliability, life cycle. 04

B Explain the Hopkinson and Doherty rates of tariff. 04

C A power plant of 300MW capacity has the following particulars: 08

Capital cost=Rs 30,000/KW installed.

Interest and depreciation=15%
Annual load factor=60% Annual capacity factor=54%
Annual running charges Rs. 500×10^6.
Energy consumed by power plant auxiliaries=5%.
Calculate the reserve capacity and cost of generation per KWh.

Unit II

Q. 3	A	Discuss the working of multi-retort underfeed stoker with the help of a neat sketch. Bring out clearly its merits.	05
	B	What are the various types of ash handling systems used? Discuss the working of any one of them.	05
	C	Following data were recorded during the testing of a condenser: Vacuum=71cm; Barometer reading=75.5cm of Hg. Condensate temperature=25ºC. Determine the partial pressure of air and steam in the condenser and the mass of air per kg of steam. Also determine the vacuum efficiency.	06

OR

Q. 4	A	Explain the working of cyclone dust collector	05
	B	State various types of impurities association with water and their effect on steam power plants.	05
	C	In a co-generation steam power plant, the boiler generates steam at 50bar, 400ºC. Which is supplied to turbine for expansion, steam at 5 bar is extracted from turbine for process heating and reminder continues to expand up to condenser pressure of 0.05 bar. The man flow rate of steam from boiler is 15kg/s. if the amount of steam extracted for process heating is 5kg/s which is condensed at 5bar from process heater. Find. 1. Power output of turbine in KW 2. Process heat energy utilized in KW 3. Effectiveness of co-generation.	06

Unit III

Q. 5	A	Explain in details the various plants used based on the availability of quality of water.	06
	B	Derive an expression for maximum work in Brayton cycle and prove that.	06

$W_{max} = C_P(\sqrt{T_{max}} - \sqrt{T_{min}})^2$

	C	Define specific speed and state its significance. State the range of specific speeds for various types of water turbine.	06

OR

Q. 6	A	Discus various types dams with neat figure. Bring out clearly their applications.	06
	B	Why combined cycles are used? Represent a combined gas and steam cycles are on T-S diagram. If the efficiency of individual cycles are η_1 and η_2 what is the efficiency of combined cycle?	06
	C	In a gas turbine plant the compressor takes in air at a temperature of 15ºC and compresses it to 4 times of its initial pressure with an isentropic efficiency of 85%. The air is then passed through a regenerator heated by turbine exhaust gases before reading to combustion chamber. The effectiveness of regenerator is 0.8. The maximum temperature of cycle is 600ºC and gases expand to their initial pressure in turbine with isentropic efficiency of 85%. Find the thermal efficiency of the plant and net power output if man flow of air is 20kg/s. C_P=1.05KJ/kgk, r=1.4 Neglect the effect of man of fuel.	06

SECTION II

Unit IV

Q. 7	A	What do you understand by breeding? Name any such nuclear power plant. Describe in brief giving neat sketch, working of Fast breeder reactor.	08
	B	Draw a typical layout of a diesel power station and explain.	08

OR

Q. 8	A	Explain with neat sketch BWR. What are the merits of BWR.	04
	B	Compare between nuclear and thermal power plants.	04
	C	Draw performance characteristic curves of diesel power plants.	04
	D	Discuss various losses in I.C. engines.	04

Unit V

Q. 9	A	Discuss the advantages of hydrogen cooling over air cooling in large capacity generators.	04
	B	Write short notes on any two i. Circuit breaker ii. Protective relay iii. Switch gear	08
	C	Explain single basis and double basis tidal power plant with neat diagrams.	06

OR

Q. 10	A	How the electrical distribution systems are classified? Explain by schematic diagrams the primary and secondary A.C. distribution systems.	06
	B	What are high temperature solar thermal power plants? Discuss the working of central receiver tower power plant.	06
	C	Write a short note on 'necessity and methods of cooling of transformers'.	06

Unit VI

Q. 11	A	Discuss the various methods in brief to control pollutants of power plants.	08
	B	Write a note on 'Noise pollution in thermal power plants and its control'	08

OR

Q. 12	A	Write short notes on any three. a. Acid rain b. Thermal pollution c. Impact of cooling tower d. Global warning and green house effect.	12
	B	How SO_2 can be controlled caused by power plants? What is pre and post treatment?	04

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

UNIVERSITY OF PUNE

[4364]-442

B. E. (*Mechanical*) Examination - 2013

MECHANICAL SYSTEM DESIGN (2008 Course)

[Time: *4* Hours] **[Max. Marks: 100]**

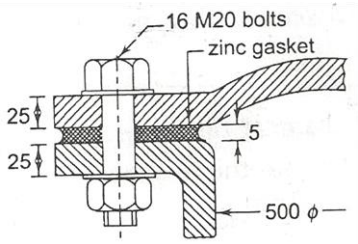
Instruction

1 *Answer 3 questions from section-I and 3 questions from section-II.*
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 *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
6 *Assume suitable data, if necessary.*

SECTION -I

Q.1 A Explain with the help of neat sketches, the different types of formed heads used as end closures in cylindrical pressure vessels. State their advantages, disadvantages and applications. 06

B The cover of a cylindrical pressure vessel made of cast iron is shown in fig.1 The inner diameter of the cylinder is 500 mm and the internal pressure is limited to 2MPa. The cover is fixed to the cylinder by means of 16 bolts with a nominal diameter of 20 mm. Each bolt is initially tightened with a preload of 20 KN. The bolts are made of steel
FeE250 (S_{yt} = 250 N/ mm^2). Assume.
E for steel = 207 KN/mm^2
E for cast iron = 100 KN/mm^2
E for Zinc = 90 KN/mm^2
Determine the factor of safety for bolts considering the effect of the gasket. 12



OR

Q.2 A Explain the design of openings in pressure vessels by' area for method of compensation' 06

B A 10^3 capacity cylindrical pressure vessel with torispherical heads is to be used to store water at a temperature of 160^o C (Water vapour pressure 6.4 bar absolute). The crown and knuckle radii for the torispherical heads are taken as 0.75 di and 0.125 di respectively. The shell as well as heads is made of plain carbon steel with allowable tensile stress of 85 N/mm^2. The single welded butt joints with backing strips are used to fabricate the vessel. The total length of the vessel is limited to 5m. 12

i) Which class vessel is to be used for this purpose?
ii) Determine minimum vessel diameter and the corresponding thickness of the vessel shell.
iii) Determine dimensions of the torispherical head. Assume weld joint efficiency or shell & head = 0.9

Q. 3 A What is a desirable property of I.C. engine piston material? State the materials used for I.C. engine piston. 04

B The following data is given for a four- stroke diesel engine : 12

Cylinder bore = 250 mm
Length of stroke = 300 mm
Speed = 600 rpm
Indicated mean effective pressure = 0.6 MPa.
Mechanical efficiency = 80 %
Maximum gas pressure = 4 MPa
Fuel consumption = 0.25 kg per BP per hr.
Higher calorific value of fuel = 44000 KJ/kg
Assume that 5% of total heat developed in the cylinder is transmitted by the piston. The piston is made of gray C.I FG 200 (Sut = 200 N/mm^2 and K = 46.6 $W/m/^oC$) and the factor of safety is 5. The temperature difference between the center and the edge of the piston head is 220^oC.

i) Determine the thickness of piston head by strength consideration and thermal consideration.
ii) State whether the ribs are required, IF so calculate the number and thickness of ribs.
iii) State whether a cup is required in the top of piston head, If so calculate the radius of the cup.

OR

Q. 4 A The following data is given for the connecting rod of a diesel engine. 16

Cylinder bore = 85 mm
Length of connecting rod = 350mm
Maximum gas pressure = 3 MPa
Factor of safety against buckling failure = 5
(ℓ/d) ratio for piston pin bearing = (1.5)
(ℓ/d) ratio for crank pin bearing = (1.25)
Allowable bearing pressure for piston pin bearing = 13MPa
Allowable bearing pressure for crank pin bearing = 11 MPa.
length of stroke = 140 mm
Mass of reciprocating parts = 1.5 kg
Engine speed = 2000 rpm
Thickness of bearing bush = 3 mm
Material of cap = 40 C8 (S_{yt} = 380 N/mm^2)
Material of bolts=Alloy steel (S_{yt}=450N/mm^2)
Factor of safety for cap and bolts = 4 and 5 respectively.
Density of connecting rod = 7800 kg/m^3
Determine :
i) Dimensions of the cross-section of connection rod.
ii) Dimensions of small and big and of bearings.
iii) Nominal diameters of bolts for the cap
iv) Thickness of cap; and
v) Magnitude of whipping stress.

Q. 5 A Explain the Johnson's method of optimum design. 04

B A cantilever beam of the length 250mm & rectangular cross section is subjected to varying load $\pm$ 100N. The width to depth ratio of the beam is 5:1; If the factor of safety is; design the beam for optimum material cost and find required dimensions of beam. Use following materials. 12

Material	Mass density 'ϱ' kg/m^3	Material cost/ unit weight 'C' Rs/N	Endurance limit 'Se'N/mm^2
M 1	8450	100	17
M 2	8020	100	37.5
M 3	7830	60	32

OR

Q. 6 A Differentiate between optimum design problems with normal specifications and redundant specifications 04

B A tensile bar of cross- sectional area at least 85mm^2 and length of 200 mm is subjected to a constant load of 500 N. Design a bar for minimum cost, of the following materials. Assume factor of safety as 2. 12

Material	Mass Density (kg/m^3)	Material cost (Rs / N)	Yield strength MPa
M 1	7500	16	130
M2	3000	32	50
M3	2100	32	20

SECTION II

Q. 7 A A beam of circular cross- section is subjected to pure bending moment M and the bending stresses are given by the following equations : 10

$$\sigma = \frac{32\ M_b}{\pi d^3}$$

Where d is the diameter of the beam. It has been observed that the diameter (d) of the beam is a normally distributed random variable with a mean of 50 mm and a standard deviation of 0.125mm. The bending moment (M_b) is also a normally distributed random variable with mean of 1750 N-m and a standard deviation of 150 N-m. Determine the mean and standard deviation of the corresponding bending stress variable (σ). Comment on the analysis.

Use the following equations :

Function, ~~z~~ = $\frac{X}{Y}$, $\mu_{\sim z} = \frac{\mu_x}{\mu_Y}$, $\widehat{\sigma_z} = \frac{1}{\mu_Y}\left[\frac{\mu x^2\ (\widehat{\sigma_y})^2 + \mu_Y^2\ (\widehat{\sigma_x})^2}{\mu_y^2 + (\widehat{\sigma_y})^2}\right]^{1/2}$

Function, ~~z~~ = x^3, $\mu_{\sim z} = \mu_x^3 + 3\mu_x\,(\widehat{\sigma_x})^2, \widehat{\sigma_z} = 3\mu_x^2\ (\widehat{\sigma_x}) + 3(\widehat{\sigma_x})^3$

B Explain the factors to be considered while designing the components for castings. 06

OR

Q. 8 A A shaft and baring assembly have following dimensions: 08

Shaft – ϕ 40 $\pm$ 0.3 mm with standard deviation of 0.1mm.

Bearing bore – ϕ 40.5 $\pm$ 0.3 mm with standard deviation of 0.1mm.

Find the percentage of assemblies with i) Clearance less than 0.25 mm and ii) Clearance between 0.25 mm and 0.35mm.

Areas under standardized normal distribution curves from -∞ to Z are as under

z	-3	-2.5	-2.0	-1.8	-1.6	-1.4	-1.2	-1.0	-0.5	-0.3	-0
Area	0.00135	0.0062	0.0228	0.0359	0.0548	0.0808	0.1151	0.1587	0.3085	0.3821	0.5
z	+3	+2.5	+2.0	+1.8	+1.6	+1.4	+1.2	+1.0	+0.5	+0.3	+0
Area	0.9986	0.9938	0.9773	0.9641	0.9452	0.9192	0.8849	0.8413	0.6915	0.6179	0.5

Assume linear interpolation for values in between.

B Write a short on man-machine closed loop system. Also clearly highlight the factor which influence this cycle. 08

Q. 9 A Explain the following terms with reference to machine tool gear box. How these parameters are decided while designing machine tool drives 06
i) Range ratio ii) Number of transmission groups or stages iii) Transmission range.

B Draw the structure and gear box diagrams for the following equations of twelve speed gear box and determine the maximum transmission range for each equation: 08
i) Z= 2(6) 2(1) 3(2) ii) Z = 2(3) 2(6) 3(1) iii) Z = 2(6) 2(3) 3(1)

C How are preferred number series used in the design of a multi-speed gear box 04

OR

Q. 10 A A three stag, twelve speed gear box is to be designed for spindle speed varying between 60 r.p.m and 2880 r.p.m The second stage consists of three speed steps. If the gear box is driven by 5 kW, 1440 r.p.m. electric motor : (i) draw the ray diagram; (ii) draw the gearing diagram; and (iii) determine the number of teeth on gears. Assume same module for all gears. 14

B What are the various laws for stepped regulation of speeds in multi-speed gear boxes? State their relative advantages and limitations. 04

Q. 11 A A triple ply belt conveyor is required to transport 2 ton of iron ore per hour through a distance of 1000m and a height of 300 m. The permissible belt speed is 90m/min. if the mass density of iron ore is 2.5 ton per cubic meter, determine : (i) the belt width; (ii) the diameter of drive pulley; and (iii) the reduction ratio of gear reducer, if electric motor speed is 1440 r.p.m. Use following data: 10

Flowability factor ‘k’:

Belt inclination, á’	10^o-15^o	16^o-20	21^o-25^o	26^o-30^o	31^o-35^o
Flow ability factor ‘k’	2.65×10^{-4}	2.5×10^{-4}	2.35×10^{-4}	2.20×10^{-4}	2.05×10^{-4}

Standard belt widths :
400,450,500,600,650,750,800,900,100,1200,1400,1600,1800, 2000 mm material factor for plies for Capron belt : $K_1 = 2.0$; belt tension and arc of contact factor : $K_2 = 80$.

B Explain the procedure to estimate the power requirement for belt conveyors. 06

OR

Q. 12 A A belt conveyor is to be designed to carry bulk material at the rate 300×10^3 kg/hour with the following details: 10
Bulk density of the material = 800 kg/m^3; Angle of surcharge of bulk material = 15^o; Belt speed = 10 km/hour; Material factor for plies, $k_1 = 2.0$; Belt tension and arc of contact factor, $k_2 = 63$; Number of plies for the belt = 4 suggest :
i) Suitable width for the belt.
ii) Diameter and length of the drive pulley.

B What are the design considerations in selecting the belt speed of a conveyor? 06

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

UNIVERSITY OF PUNE
[4364]-443
B. E. (Mechanical Engineering) (Automobile) - 2013
COMPUTATIONAL FLUID DYNAMICS (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 *Assume suitable data, if necessary.*

SECTION -I

Q.1 A Explain the significance of divergence of velocity and substantial derivative. How substantial derivative different than derivative in differential calculus? 10

B List two types of errors encountered in numerical methods and indicate how the error occurs? 6

OR

Q.2 A Explain the various flow models in CFD. What are conservation and non-conservation form of governing equations? 8

B Derive the continuity equation in differential conservation form for 3D, unsteady, compressible flow. 8

Q. 3 A Explain and write Thomas Algorithm for solution of Tridiagonal matrix. Solve the following Tridiagonal system with Thomas Algorithm to find T_1, T_2, T_3, T_4 12

$$\begin{pmatrix} 2.04 & -1 & 0 & 0 \\ -1 & 2.04 & -1 & 0 \\ 0 & -1 & 2.04 & -1 \\ 0 & 0 & -1 & 2.04 \end{pmatrix} \begin{pmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \end{pmatrix} = \begin{pmatrix} 40.8 \\ 0.8 \\ 0.8 \\ 200.8 \end{pmatrix}$$

B Derive the following finite difference approximations for applications in 2D fluid flow at point (i,j) 6

$$\frac{d^2y}{dx^2} = \frac{2y_{i,j} - 5y_{i+1,j} + 4y_{i+2,j} - y_{i-3,j}}{(\Delta x)^2} + 0(\Delta x)^2$$

OR

Q. 4 A Explain : Dirichlet, Neumann and Mixed type boundary conditions. 4

B Consider steady state heat through circular cross sectioned, tapered in length fin with temperature at fin base and the surrounding fluid as T_b =125^{0}C, T_f = 25^{0}C respectively. (Refer Figure 1) Assume T_5 = 25^{0}C. Obtain temperature of nodes 2,3,4. Assume thermal conductivity of fin material k = 1 W/mK and heat transfer coefficient for surrounding fluid h=10W/m^{2}K. Derive the governing equation from the basic energy equation. Use numerical technique to solve. 12

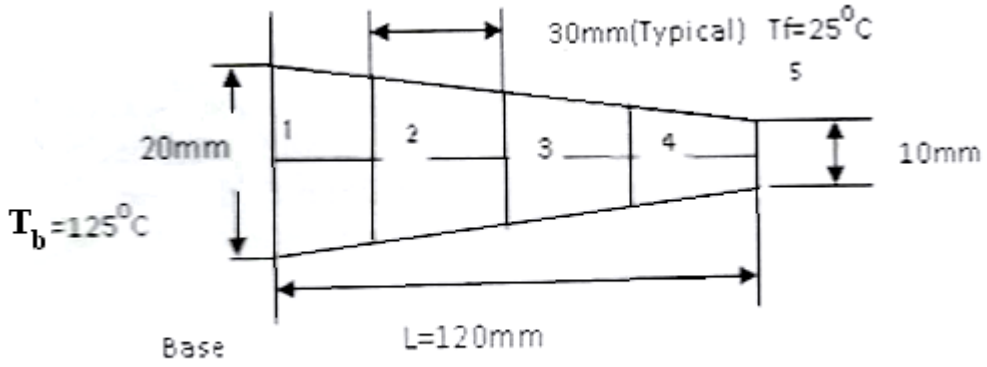
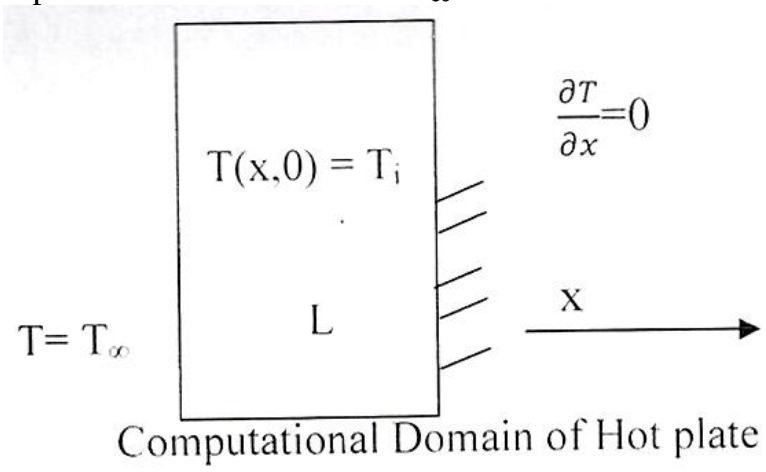


Figure 1

Q. 5 A A lot infinite long plate (in y and z direction) of thickness 2L, suddenly exposed to the cool fluid at T_∞ 16



Computational Domain of Hot plate

Figure 2

Initial temperature of the plate is T_i ($T_i > T_\infty$) (Refer Fig. 2)

Assuming properties k ,ρ and C constant, the non-dimensional energy equation for the plate is

$$\frac{\partial\theta}{\partial\tau} = \frac{\partial^2\theta}{\partial X^2}$$

Where , $\theta = \frac{T-T_\infty}{T_i-T_\infty}$, X = $\frac{x}{L}$, $\tau = \alpha t/L^2$

And

IC at τ =0; $\theta = 1$ for all X

BC'S are at X = 0; θ = 0,

at X =1, $\frac{\partial \theta}{\partial X}$ =0

Descritise the equation using finite difference formulation and present the step by step the solution procedure either by implicit or explicit scheme.

OR

Q. 6 A Two parallel plates extended to infinity are a distance of 40 mm apart. The fluid within the plates has kinematic viscosity of 2.17 x 10^{-4} m^2/s and density of 800 kg/$m^{3.}$ The lower plate is stationary and upper plate is suddenly set in a constant velocity of 40 m/s. Find the velocity distribution within fluid in y direction for one time step (Δt). Use 5 nodes for finite differencing and apply Crank Nicolson's implicite method. Take Δt = 0.55. Recall that the governing equation is reduced from Navier-Stokes equation and is given by: 10

$\rho \frac{\partial u}{\partial t} = \mu \frac{\partial^2 u}{\partial y^2}$

With usual notations.

B Explain explicit and implicit method for the solution of PDEs with suitable example. State its advantages and limitation over each other. 6

SECTION II

Q. 7 A Following 2D heat conduction equation is valid over the interval 16

$0 \leq x \leq 1, 0 \leq y \leq 1$, t(time) ≥ 0.

$\frac{\partial T}{\partial t} = \alpha \left(\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2}\right)$

Initial distribution of Temperature (T) at t =0 is given by,

T(x,y,0) = sin ($2\pi y$)*sin($2\pi x$)The value of T over the boundary remains at T = 0^0C for t≥o. Find temperature variation using h=1/3 along x and y direction and choosing Δt = (1/20) s. Explain use of "Alternate Direction Implicite Method" (ADI) for such problem. Find values at intermediate step i.e. t =(1/40)s. At fixed value in y direction, 'sweep' in x direction, to calculate T at t =$\frac{\Delta t}{2}$.

OR

Q. 8 A Compute the solution of the equation $\frac{\partial u}{\partial t}$ + C $\frac{\partial u}{\partial x}$ = 0, where C(Constant)>1 for the first two-steps, using 12

i) Lax-wendroff scheme

ii) Mac-cormack scheme

With initial condition:

U(x,0) = x-x^2, 0≤ x≤ 1

u(x,0) = 0 0 > 1

and boundary condition u(0,t) = 0 all t, taking $\Delta x = {}^{1}/_{4}$, r= (C*Δt)/ Δx = ${}^{1}/_{2}$. u is displacement.

B With suitable example explain application of control volume technique in heat transfer and fluid flow. 4

Q. 9 A Consider a thin rod moving with a velocity u= 10^{-5} m/s as shown in figure 3. The periphery of the rod is perfectly insulated. The rod subjected to a specified temperature :- 16

$T_0 = 25^oC$ for $x \leq 0$ and $T_1 = 300^oC$ for $x \geq L$.

Model the domain into 4 elements and find the temperature of rod at the node points. You may assume governing equation to be ID, steady, Convection Diffusion equation. Solve using i) Central difference formula and ii) Upwind differencing Approach. Drive the formulas used Assume $\alpha = 10^{-5}$ m^2/s for rod.

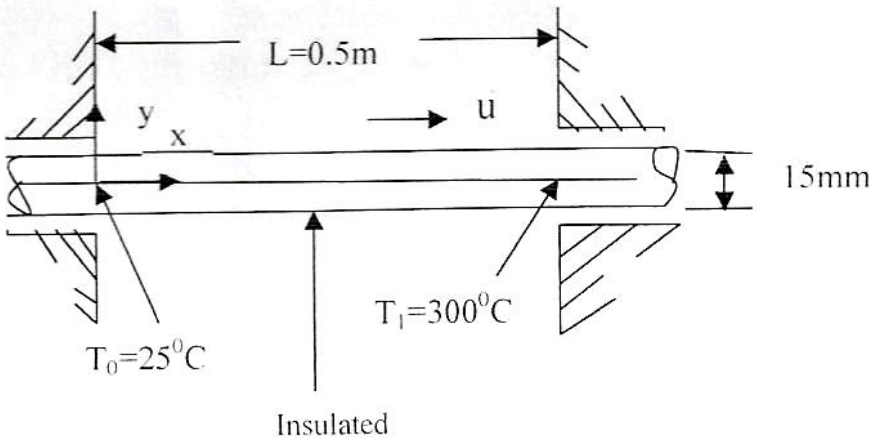


Figure 3

i)

OR

Q. 10 A Develop solution methodology for 2D, unsteady convection-diffusion equation giving practical example. Explain about possible boundary conditions. 10

B Explain, in brief, the procedure of CFD simulation 6

Q. 11 A Write down step by step procedure for SIMPLE algorithm 10

B Explain different types of Grids & Grid generation process 6

OR

Q. 12 A Write short note on: 10

i) Finite volume method ii)Navier Strokes equations 6

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *8*]

UNIVERSITY OF PUNE

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B. E. (*Mechanical*) (Automobile)- 2013

Finite Element Method (2008 Course)

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

SECTION –I

UNIT-I

Q.1 A Explain the terms essential and natural boundary conditions. Give example of essential boundary condition for the beam element used for structural analysis (i.e. to find displacements and stresses) as well as thermal analysis (i.e. to fine temperatures and fluxes). 8

B Explain with sketch the concept of axi-symmetric problems in solid mechanics. How does axi-symmetry differ from planer symmetry? 8

OR

Q.2 A Explain in detail the difference between Finite Difference Method and Finite Element Method. 8

B Describe in detail the concept of Cholesky's decomposition, and banded skyline solutions to solve the simultaneous equations in matrix from. 8

UNIT-II

Q. 3 A For the plane truss show in Figure 3a, determine the following. Each element has E=70 GPa, and area A=200 mm^2. P=1 kN. 8

i. Write down the elemental stiffness matrices (k) for each element,
ii. Assemble k matrices to get global stiffness matrix (K),
iii. Apply boundary conditions,
iv. Find horizontal and vertical displacement of node 1,
v. Evaluate stresses in each element,
vi. Determine reactions forces at node 2, 3, and 4.

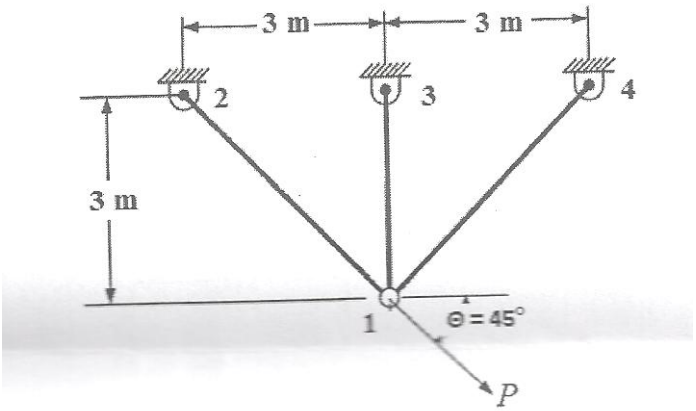


Figure 3a

B Determine the displacement and slope (i.e. θ) at the load point for the stepped beam show in Figure 3b. Each elements has E=200 GPa. The area moment of inertia are given as $I_1=1.25\times10^5$ mm^4, and $I_2=4\times10^4$ mm^4. Clearly show the elemental stiffness matrices (k) each element, assembly of k matrices to get global stiffness matrix (K) and application of boundary conditions. 10

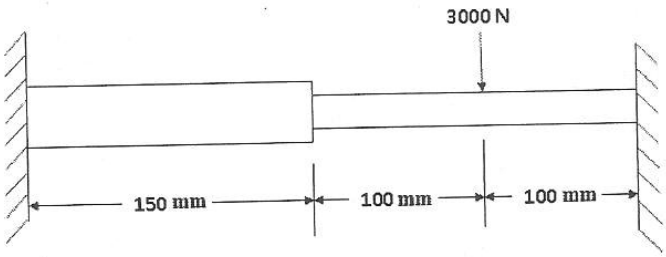


Figure 3b

OR

Q. 4 A Derive elemental stiffness matrix and force vector for two noded (linear) bar element using Principal of Minimum Potential Energy (PMPE) Method. The bar elements is oriented in x-direction as shown in Figure 4a. Use local coordinate (x) system for the derivation. Assume that only surface tractions ($T_{x)}$ are acting on bar element. Ignore concentrated forces and the body forces. 10

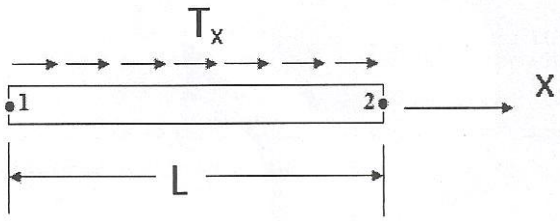


Figure 4A

B A beam element of length L and constant E and I is shown in Figure 4B. If the uniform distributed load (q) and concentrated force (F) act on the beam as 8

shown in Figure 4b, compute the equivalent consistent nodal force at node 2.

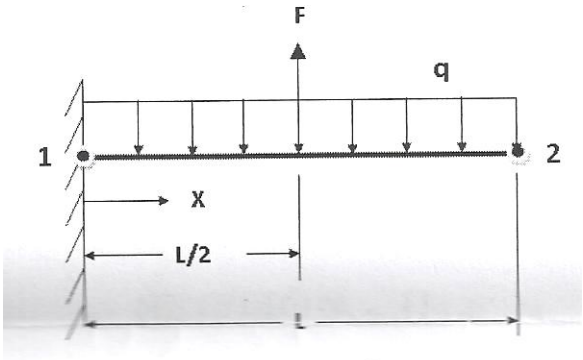


Figure 4b

UNIT-III

Q. 5 A Evaluate the following integrals using three-point Gaussian quadrature method.

a) $I = \int_{-1}^{1} [x^2 + \sin(\frac{x}{2})] dx$ 8

b) $I = \int_{-1}^{1} [3^x - 4x] dx$ 8

B

OR

Q. 6 A Explain the difference between p and h refinements in Finite Element Method. 5

B Explain the different between iso-parametric, sub-parametric and super-parametric elements. 5

C The iso-parametric shape functions for CST element as shown in Figure 6b are given as $N_1 = \zeta$, $N_2 = \eta$, and $N_3 = 1 - \zeta - \eta$. Evaluate shape functions at interior point P. Also, if temperatures at node 1,2 and 3 are 25°, 30°, and 50° respectively, evaluation the temperature at the interior point P. 6

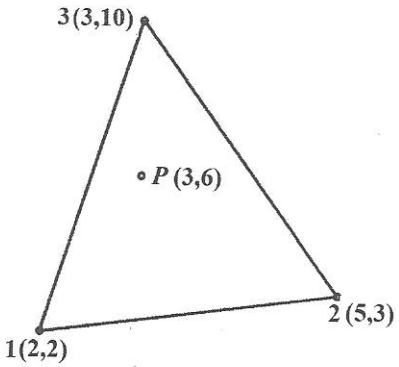


Figure 6b

SECTION II
UNIT-IV

Q. 7 The fin shown in Figure 7 is insulated on the perimeter. The left end has a constant temperature of 100°C. A positive heat flux of q =5000W/m^2. Acts on the right end. Let K_{xx}=6W/(m°C) and cross sectional area A=0.1 m^2. Determine the temperatures at L/4, L/2, 3L/4, and L where L =0.4m. 16

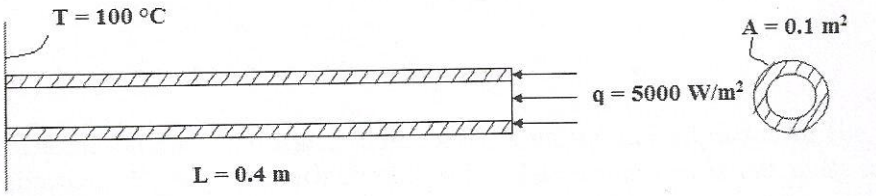


Figure 7

OR

Q. 8 A Derive elements stiffness matrix formulation for one dimensional steady state Heat Conduction problems. 6

B A composite wall consists of three materials is shown in Figure 8b. The outer temperature is T_0=20 °C. Convection heat transfer takes place on the inner surface of the wall with T_∞=800 °C and h=25W/(m^2 °C).Determine the temperature distribution in the wall. 10

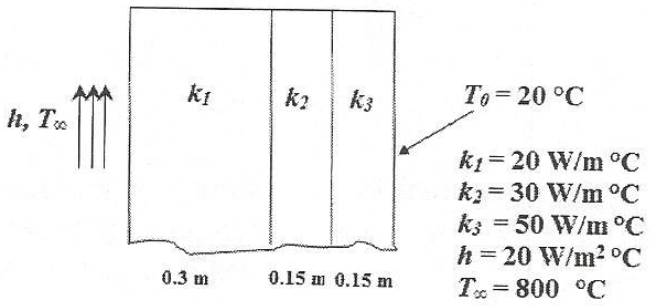


Figure 8b

UNIT-IV

Q. 9 For the stepped beam (with fixed-pin boundary conditions) shown in Figure 9, set-up the problem (find characteristic equation) to determine first three natural frequencies. Each element has E=200GPa, density p=7500kg/m^3, $I_1=1.5\times10^{-6}$ m^4, $I_2=8.8\times10^{-7}$ m^4, $A_1=2.4\times10^{-3}$ m^2, $A_2=8.5\times10^{-4}$ m^{-2}.Use consistent mass matrix. 18

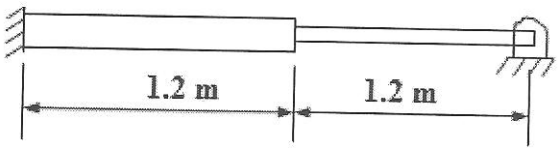


Figure 9

OR

Q. 10 A Find the un-damped natural frequencies of longitudinal vibration of the stepped bar shown in Figure 10 a with the following data using consistent mass matrices: 12

$L_1=L_2=L_3=0.2$m, $A_1=2A_2=3A_3=0.4\times10^{-3}$ m^2, $E=2.1\times10^{11}$ N/m^2, and $\rho=7.8\times10^3$kg/m^3.

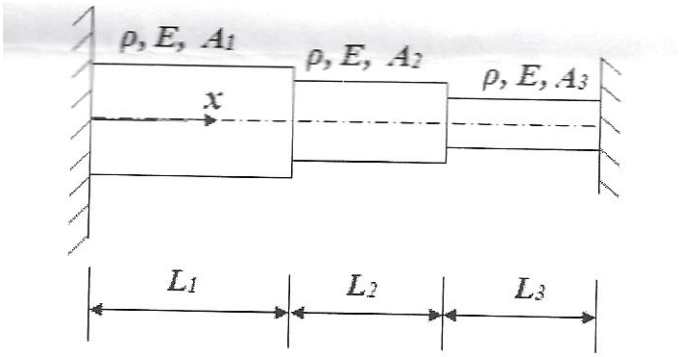


Figure 10a

B Explain the difference between lumped mass matrix and consistent mass 6

matrix.

Unit-VI

Q. 11 A What are the advantages and limitations of free and mapped meshing in Finite Element Method. What type of meshing would you prefer for complex geometries. Explain your answer with neat sketches. 6

B Consider the problem shown in Figure 11b for the calculation of natural frequencies of transverse vibrations of a beam. Write all the necessary inputs required for preprocessing of this problem. (DO NOT solve the problem) 10

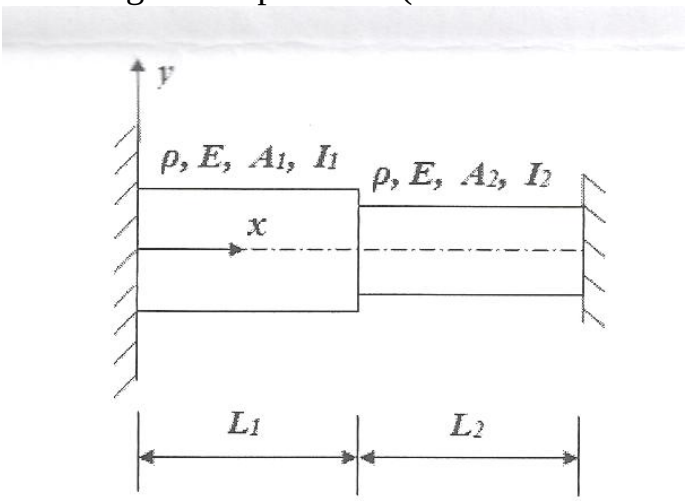


Figure 11b

OR

Q. 12 A Define wrap angle and skewness. Explain their significance in Finite Elements Method. 8

B Write a note on various steps involved in the processing step, to solve for 1D heat transfer problem using Finite Element Problem. 8

Data Sheet for Reference

Shape Functions

1. Bar Element: $N_1 = 1 - \frac{x}{L} \qquad N_2 = \frac{x}{L}$
2. Beam Elements: $N_1 = \frac{1}{L^3}(2x^3 - 3x^2L + L^3)$

$$N_2 = \frac{1}{L^3}(x^3L - 2x^2L^2 + xL^3)$$

$$N_3 = \frac{1}{L^3}(-2x^3 - 3x^2L)$$

$$N_4 = \frac{1}{L^3}(x^3L - x^2L^2)$$

Elemental Stiffness Matrices

1. Bar Element: $k_{bar} = \frac{AE}{L}\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$
2. Beam Element: $k_{beam} = \frac{EI}{L^3}\begin{bmatrix} 12 & 6L & -12 & 6L \\ 6L & 4L^2 & -6L & 2L^2 \\ -12 & -6L & 12 & -6L \\ 6L & 2L^2 & -6L & 4L^2 \end{bmatrix}$
3. Truss Element:

   C=cos (θ) and S=sin (θ)

   θ is positive in anti clockwise direction.

$$k_{truss} = \frac{AE}{L}\begin{bmatrix} C^2 & CS & -C^2 & -CS \\ CS & S^2 & -CS & -S^2 \\ -C^2 & -CS & C^2 & CS \\ -CS & -S^2 & CS & S^2 \end{bmatrix}$$

Elemental Mass Matrices

1. Bar Element:
   a) Consistent mass matrix: $m_{consistent} = \frac{pAL}{6}\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$

   b) Lumped mass matrix: $m_{lumped} = \frac{pAL}{2}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

2. Beam Element:

a) Consistent mass matrix:

$$m_{consistent} = \frac{pAL}{420}\begin{bmatrix} 156 & 22L & 54 & -13L \\ 22L & 4L^2 & 13L & -3L^2 \\ 54 & 13L & 156 & -22L \\ -13L & -3L^2 & -22L & 4L^2 \end{bmatrix}$$

b) Lumped mass matrix:

$$m_{lumped} = \frac{pAL}{2}\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Heat Transfer Matrices

k matrix for Conduction + Convection for bar element:

$$k = \frac{Ak}{L}\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} + \frac{hPL}{6}\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

Where, A= cross sectional area, K=Thermal Conductivity, L=Length of element, h=Convection Coefficient, and P=Perimeter.

Gauss Quadrature

Table for Gauss Points for integration from -1to 1

$$\int_{-1}^{1} y(x)dx = \sum_{i=1}^{n} W_i y_i$$

Number of Points	Locations, x_i	Associated Weights, W_i
1	x_1=0.000	2.000
2	$x_1, x_2 = \pm 0.57735$	1.000
3	$x_1, x_3 = \pm 0.77459$ $X_2 = \pm 0.000$	5/9=0.55556 89=0.88889
4	$x_1, x_4 = \pm 0.86113$ $x_2, x_3 = \pm 0.33998$	0.34785 0.65214

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

UNIVERSITY OF PUNE
[4364]-446
B. E. (*Mechanical*) Examination - 2013
(Advanced Air Conditioning & Refrigeration)(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. *Draw neat diagrams wherever necessary.*
4. *Figures to the right indicate **full marks.***
5. *Answer **three** questions from **Section I** and **three** questions from **Section II.***

SECTION -I

Q.1	A	Explain ejector-expansion transcritical refrigeration cycle.	6
	B	1 TR HFC-134a refrigerating machine operates between a condenser temperature of 40℃. Calculate the increase (%) in the theoretical piston displacement/TR and the power consumption/TR of the cycle: take c_p of gas as 1.4 kJ/kg.K i. If the evaporating temperature is reduced to -30℃. ii. If the condensing temperature is increased to 60℃.	12

Ts(℃)	h_f(kJ/kg)	h_g(kJ/kg	S_f(kJ/kg)	S_g(kJ/kg)	v(m^3/kg)
-30	162.33	387.08	-	1.7766	0.2240
0	200	405.17	-	1.7511	0.0689
40	256.43	426.17	1.1930	1.7350	0.0199
60	288.34	433.91	1.2893	1.7263	0.0114

OR

Q.2 A Explain actual vapour compression cycle using p-h and T-s diagram 10

B Write a short note on **(any two of following)** 8

i. Thermo bank hot defrosting

ii. LP receivers

iii. Secondary refrigerants

iv. system practices for multi pressure system

Q. 3 A Discuss the various methods of capacity controls of reciprocating compressor. 6

B Design 134a shell & tube condenser to meet the following conditions; 10

Refrigeration load	50 TR
Condensing temperature	55℃
Evaporating temperature	-15℃
Water inlet temperature	27℃
Range of cooling tower	6℃
Heat rejection factor	1.013
Maximum tube length & diameter	3.6576 m & 2.54cm
Fouling factor	0.001 m^2K/W
HTC inner & outer side	6000 W/m^2.K &

		respectively 1500 $W/m^2.K$	
		State the selection basis of condenser.	
		OR	
Q. 4	A	Explain the principle of operation of cooling tower with psychrometric chart.	4
	B	Explain Pumped circulation system.	6
	C	Write a short note on: a. Electronic expansion valve b. low side and high side float.	6
Q. 5	A	Explain the construction working of oil pressure failure control	6
	B	List the pollutants & contaminants present in the air with source.	6
	C	Explain the followings; i. Direct acting solenoid valve ii. Different configurations of pressure regulating valves	4
		OR	
Q. 6	A	Discuss the types of level controllers & switches.	8
	B	Discuss various pressure type safety devices	8
		SECTION II	
Q. 7	A	Write a short note on “Choice of Supply Design Conditions”	6
	B	A 35 cm brick wall with plaster on both sides exposed to the periodic temperature and incident radiant variation on an hourly basis between 7 am and 6 pm is given in the table. Determine the average and peak load on the air conditioner	12

maintaining the room at 25℃ per unit area of the wall. Also determine the heat gain at 5 pm and time of peak load. Use time lag & decrement method.

Absorptivity of surface, a=0.8

Thermal conductivity of plaster, k=0.14 W/mK

Thickness of plaster material=3mm

Thermal conductivity, k=1.5 Wm/K

Outside wall coefficient, h_o=23 W/m^2K

Inside wall coefficient, h_i=7 W/m^2K

Average sol-air temperature (T_{em})=44.14℃

Time lag=5 hrs; Decrement factor=0.455

Time	7 am	8 am	9 am	10 am	11 am	12 noon	1 pm	2 pm	3 pm	4 pm	5 pm	6 pm
T_o(℃)	29	31.5	33.5	35.5	37	38.5	39.5	40.5	41.5	39.5	39	38
I (W/m^2)	186	390	640	814	954	1000	960	825	645	385	190	47

OR

Q. 8	A	Explain technical guidelines for Star rating of unitary product	6
	B	Explain the ETD method of estimating heat transmission load through building wall	6
	C	State the factors affecting outside design conditions	6
Q. 9	A	State factors considered in HVAC design of Pharmaceutical.	8
	B	Draw and explain water-to-water heat pump circuit	8

OR

Q. 10	A	A heat pump is used for heating a building with a design load of 20kW. Water at 10℃ is available as a heat source and air supplied to the room is to be at 40℃. A 5℃ differential is necessary between condensing refrigerant and supply air & between evaporating refrigerant and heat source. If the actual EPR attained is 60% of reverse Carnot cycle operating between the same temperatures, determine; i. Actual EPR of the heat pump system ii. The min. and actual power required to run the compressor.	8
	B	Discuss design considerations for hospital air-conditioning.	8
Q. 11	A	Sketch and explain Claude cycle using T-s and p-h diagram.	6
	B	Discuss specific types of insulations used for low temperature applications.	10

OR

Q. 12	A	List out the limitations of VCS for the production of low temperatures.	4
	B	1 kg of nitrogen at 30℃ and 1 bar compressed isothermally to 20 MPa in a compressor in a Linde cycle. The make-up nitrogen is supplied to the system at 30℃ and 1 bar. Determine the yield of liquid and temperature of air before throttling. Draw the schematic diagram with T-s and p-h	8

diagram. Use p-h chart of nitrogen.

C Draw circuit of Liquefaction process of hydrogen 4

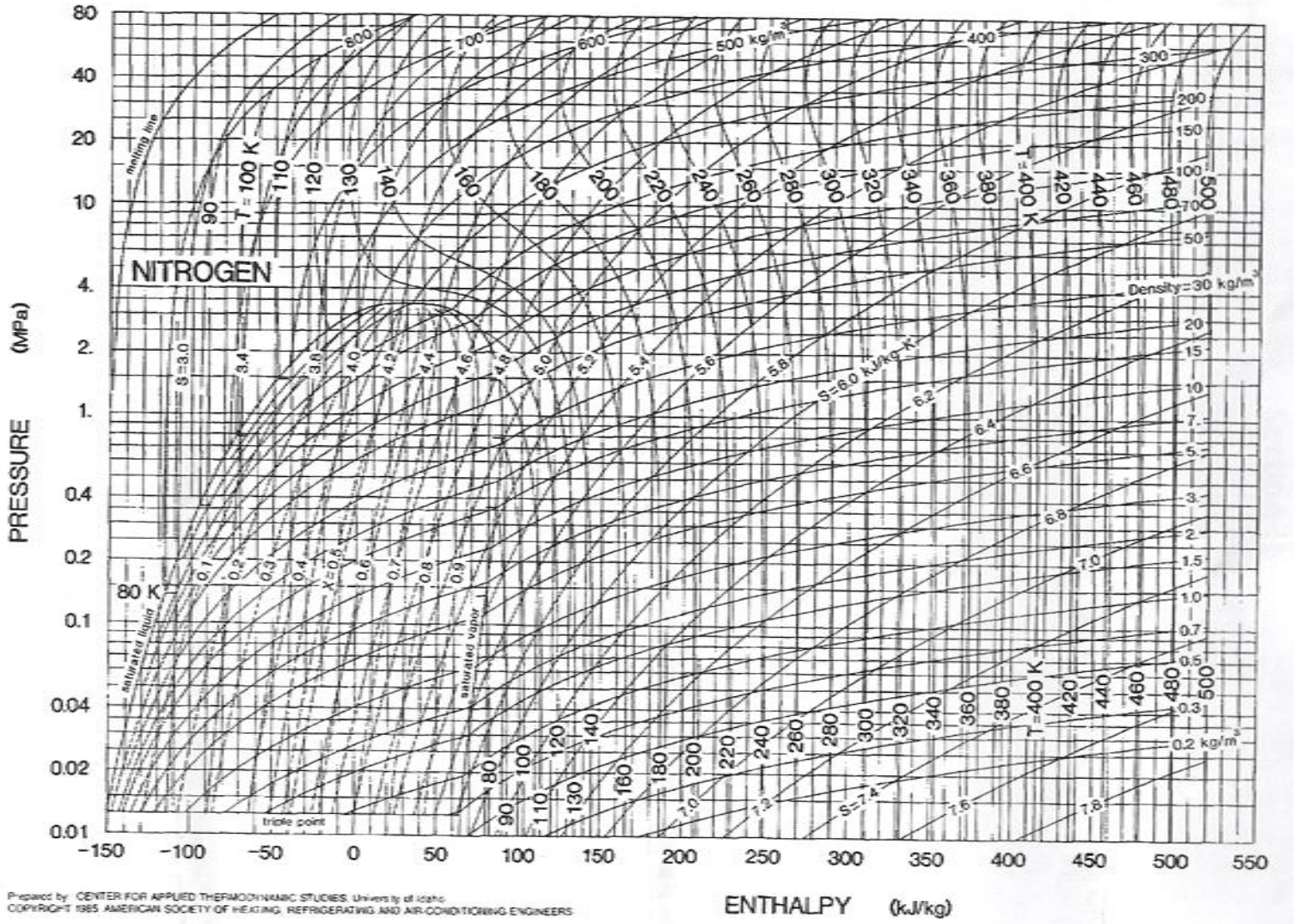


Fig. 35 Pressure–Enthalpy Diagram for Refrigerant 728 (Nitrogen)

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

UNIVERSITY OF PUNE
[4364]-447
B. E. (Mechanical) (Elective - IV)Examination - 2013
INDUSTRIAL HEAT TRANSFEER EQUIPMENTS
(Sem – II) (2008 Course)

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

Instructions:

1. *Answer any three questions from Section I and any three questions from Section II*
2. *Answers to the two sections should be written in separate answer-books.*
3. *Neat diagrams 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

UNIT I

Q.1 A Classify heat exchangers based on transfer process and geometry of construction. 6

B A 15^0C of hot water temperature drop is allowed while heating cold water with a flow rate of 4500 kg/Hr from 25^0C to 40^0C. Hot water inlet temperature is 135^0C. A 3.5 m double pipe heat exchanger of 3 inch (ID = 0.0779 m) by 2 inch (ID=0.0525 m OD=0.0603 m) is used for this purpose. Hot water flows through the inner tube. 12

Assume that the pipe is made up of carbon steel (K=54 W/mK). Neglect heat loss if any and find:

i) Hydraulic diameter (D_h)
ii) Equivalent diameter (D_e)
iii) Heat transfer coefficient in annulus (h_0)
iv) Clean over all heat transfer coefficient (U_o)

For fully developed turbulent flow Pr>0.5

$$Nu = \frac{\left(\frac{f}{2}\right) Re\ Pr}{1+8.7\left(\frac{f}{2}\right)^{1/2}(Pr-1)}$$ Where $f = [1.58\ Ln\ (Re)-3.28]^{-2}$

Properties of water at 127.5^0C:

ρ = 936.5 Kg/m^3, C_P = 4.266 KJ/KgK, K=0.687 W/mk

, μ = 0.207 X 10^{-3} Pa-S, Pr = 1.343

Properties of water at 32.5^0C:

ρ= 997.5 Kg/m^3, C_P=4.178 KJ-KgK, K=0.609W/mK, μ= 0.841 x 10^{-3} Pa-S, Pr = 5.68

OR

Q.2	A	Enumerate various criteria for selection of heat exchanger.	5
	B	What is fouling? How does it affect the performance of heat exchanger?	5
	C	Outline step by step procedure for thermal design of double pipe heat exchanger	8

UNIT II

Q. 3	A	Explain various leakage and bypass streams on the shell side. How do they affect the performance of STHE.	8
	B	Explain stepwise procedure for heat exchanger design using Kern's method	8

OR

Q. 4	A	Explain parameters affecting the allocation of streams in STHE	4
	B	Crude oil at a flow rate of 63.77 Kg/S enters a heat exchanger at 102^0C and leaves at 65^0C. The heat will be transferred to 5 Kg/S of tube side water coming from supply at 21^0C. The exchanger data is given below. 3/4" OD 18 BWG tubes (OD=0.0191m, ID = 0.01776m), on a 1" square pitch. A tube bundle of 845 Single-pass carbon-steel tubes having conductivity of 43 W/mK is used. Shell internal diameter = 0.889 m Baffle spacing = 0.275 m Number of tubes = 84 Pitch ratio = 1.25 Number of passes = 01 Calculate the length of heat exchanger for clean surface. Following properties are given:	12

Property	Shell Side	Tube Side
Specific heat (J/KgK)	2177	4186.8
Dynamic viscosity (NS/m^2)	0.0089	0.00072
Thermal conductivity (W/mK)	0.122	0.605
Density (Kg/m^3)	786.4	995
Prandtl number	33.73	6.29
Dynamic viscosity of sheel side fluid at 59^0 C = 0.00196 NS/m^2		

$$\frac{h_o D_o}{k} = 0.36 \left(\frac{d_e G_s}{\mu}\right)^{0.55} \left(\frac{\mu C_P}{k}\right)^{1/3} \left(\frac{\mu_b}{\mu_w}\right)^{0.14} \text{ for } 2\text{x}10^3 < \text{Re} < 10^6$$

UNIT III

Q. 5	A	What are the characteristic of compact heat exchanger?	8
	B	What are salient features of plate-fin Heat exchanger(PFHE)?	8

OR

Q. 6	A	What are different forms of individually finned tubes?	8
	B	"Brazed aluminium PFHE are an obvious choice for cryogenic applications"-comment	8

SECTION II

UNIT IV

Q. 7	A	Define and describe direct contact type condenser.	5
	B	Explain horizontal in tube condenser with figure.	6
	C	What is evaporative condenser? Explain with figure.	5
		OR	
Q. 8	A	Explain vertical shell side condenser.	8
	B	What is impingment plate? Why it is used? Explain one example with figure	8

UNIT V

Q. 9	A	With the help of neat ketch explain various components of cooling tower.	8
	B	Explain the cooling tower heat transfer with the help of Merkel equation	8
		OR	
Q. 10	A	Explain the factor on which selection of pumps and fan depends for cooling towers?	6
	B	Write a short note on: a) Maintenance of cooling tower b) Testing of cooling tower or parameters measured in testing.	10

UNIT VI

Q. 11	A	With the help of neat sketch explain construction and working of heat pipe.	10
	B	Write a short note on a) Working fluids used in heat pipes. b) Wick structure used in heat pipes.	8
		OR	
Q. 12	A	Explain ANY THREE of the following: a) Direct and Indirect liquid cooling b) Forced cooling c) Mounting components d) Thermoelectric cooling	18

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

UNIVERSITY OF PUNE
[4364]-448
B. E. (Mechanical Engineering) Examination - 2013
MANAGEMENT INFORMATION SYSTEMS
(Elective-IV)(Sem - II)(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. *Answer any three questions from Section I and any three questions from Section II*

SECTION –I

UNIT I

Q.1	A	Define Management, Information and system. Write shot note- Structure of MIS	8
	B	"MIS creates an impact on organizational function, performance and productivity " Justify with examples.	8
		OR	
Q.2	A	Define System. Explain various types of systems.	4
	B	Write a short note MIS- as a system.	6
	C	Define Management Give management functions at various management levels.	6

UNIT II

Q. 3	A	What is decision? Discuss MIS and decision making	6
	B	Explain waterfall model of SDLC with diagram. State its advantages and disadvantages.	6
	C	Write a short on behavioral decision making .	4
		OR	
Q. 4	A	Explain with a block diagram system development life cycle.	8
	B	Write a short note on organizational decision making.	4
	C	What are the Building block of information system?	4

UNIT III

Q. 5	A	Explain knowledge management systems?	6
	B	What is data mining. Give four applications of data mining.	6
	C	Write a short note on DFD with example	6

OR

Q. 6	A	Explain data warehousing.	6
	B	Describe E-R diagrams	4
	C	Define GDSS & its components	8

SECTION II

UNIT IV

Q. 7	A	Differentiate between Validation & verification?	6
	B	What are the different levels of CMM? Explain any three.	8
	C	Write a short note on "Quality control & Quality assurance"	4

OR

Q. 8	A	Explain UML design methodology	4
	B	Write a short note on software matrix & software model?	6
	C	What are the types of software performance testing?	8

UNIT V

Q. 9	A	Describe the criteria of choosing black box or white box approach	6
	B	Explain various software qualities attributes.	6
	C	Write a short note on: i) Fault ii) Error	4

OR

Q. 10	A	Describe Boundry Value Analysis.	6
	B	List and explain the types of software testing approaches?	4
	C	Write short note on; a) Reliability b) Availability c) Maintenance	6

UNIT VI

Q. 11	A	Explain the application of MIS in supply chain management with block diagram and flow chart	8
	B	Explain the case study on 360^0 Feedback system.	8

OR

Q. 12	A	Explain the application of MIS in Personnel management with block diagram and flow chart.	8
	B	Explain the applications of MIS in financial management with block diagram and flow chart.	8

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *4*]

UNIVERSITY OF PUNE

[4364]-449

B. E. (Mechanical) Examination - 2013

RELIABILITY ENGINEERING (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.*

SECTION -I

Q.1 A Distinguish between Reliability and Quality of the product. 4

B What is the relationship between MTTF and Reliability? 4

C In the life testing of 10 elements of a mixture ,the time to failure for each element is as below. Calculate the mean failure rate for 905 hours and the mean time to failure for all the elements. 8

Element Number	Time to failure in hours
1	800
2	805
3	810
4	815
5	820
6	827
7	838
8	848
9	875
10	905

OR

Q.2 A Describe the various components of the reliability-cost curve of the product. 6

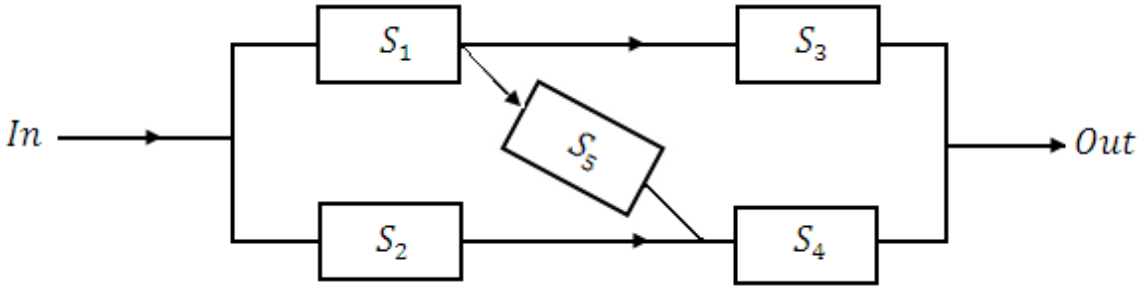
B Explain the term Probability Density Function and Cumulative Distribution Function 4

C Explain failure density function, Hazard rate and Mean Time Between Failure. 6

Q. 3 A State various probability distributions. Explain any three of them. 6

B Explain Tie Set and Cut Set method of reliability evaluation. 6

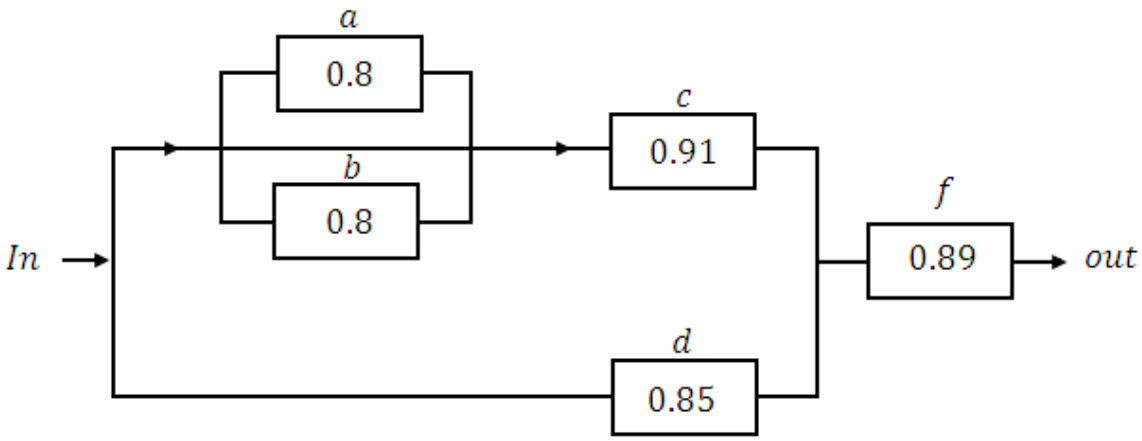
C Find the reliability of system shown in fig, having S1 ,S2, S3 and S4 non series parallel structure. 6



OR

Q. 4 A For a mechanical component following weibull distribution with $\beta = 2.5, \eta = 3000$ and I =1600.Find the reliability of the component and failure rate for the operating time of 2500 hrs. 6

B Five elements (a,b,c,d and f) of a system are connected as shown in fig. which also indicate the reliability of each component.Find the system reliability. 6



C Explain the active ,passive and stand by redundancies. 6

Q. 5 A Describe dynamic programming apportionment technique. 6

B A system of three elements 1,2 and 3 having failure rates λ_1=0.007, λ_2=0.003, λ_3=0.001 per hour respectively. Assuming mission time of 20 hours and system reliability of 0.90,find failure rates as well as reliability of each sub system for the entire mission period. 6

C A system operating from the time t=0 Prove that the probability of the system functioning properly between time t_2 and t_1 (since $t_2 > t_1$) is $Rt_2 - t_1 = 1 - R(t_1) + R(t_2)$ 4

OR

Q. 6 A Four units are connected in series with reliabilities $R_1 = 0.83$, $R_2 = 0.89$, $R_3 = 0.79$ AND $R_4 = 0.97$.Calculate the system reliability. If the reliability is to be increased to a value of 0.65, how should this be apportioned among the four units according to minimum effort method? 6

B Explain equal Apportionment and ARINC technique to determine the reliability. 6

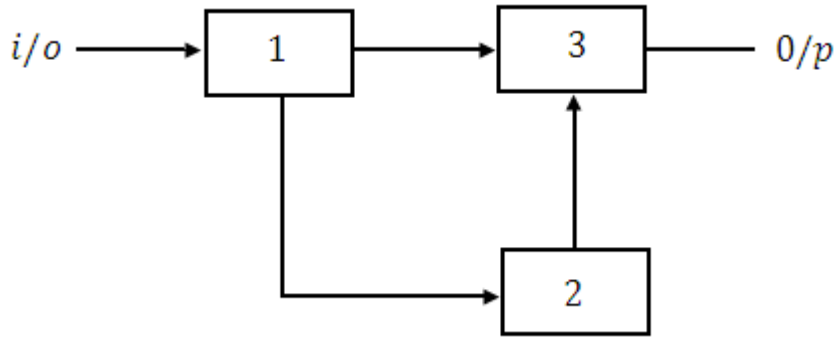
C What is reliability allocation? Write the advantages of reliability allocation method. 4

SECTION II

Q. 7	A	Explain reliability , maintainability and availability. What are the types of availabilities?	8
	B	What is Maintainability function? From the basic maintainability equation show that MTTR is the reciprocal of repair rate.	8

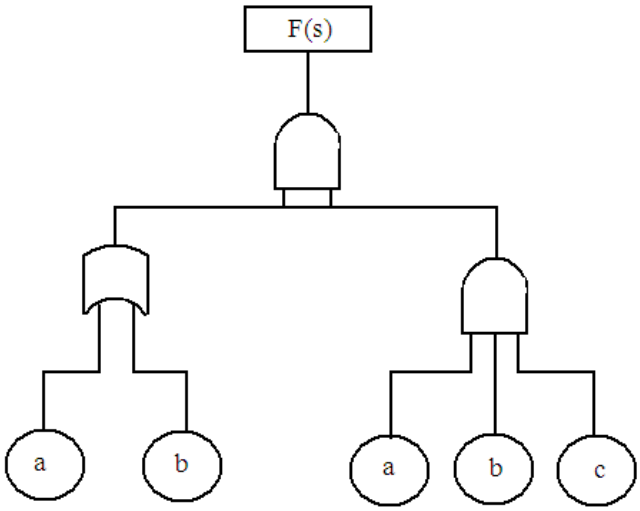
OR

Q. 8	A	For a computer unit a suitable air conditioning system has to be designed. It should have reliability valve of 0.95 for an operation of 800 hrs. The availability valve over the same period of time is required to be 0.98 .Assume constant hazards for failure and repair. Estimate MTBF and MTTR.	8
	B	Distinguish between Breakdown Maintenance and Preventive Maintenance.	4
	C	Explain Reliability Centred Maintenance.	4
Q. 9	A	Explain the methodology of constructing Fault tree diagram. What are the various symbols used while constructing the fault tree diagram?	8
	B	For the system shown in fig below, calculate the reliability using tie-set and cut-set theory.	8



OR

Q. 10	A	The figure shows a fault tree diagram.The failure rate of each element is given as λ (a)=0.025, λ (b)0.01 and λ (c)=0.005 .Find out the failure rate of the system.	8



B Describe the method of obtaining critically of a component or a sub system using Risk Priority Number (RPN). 8

Q. 11 A Explain the Markov model. How it is applied in reliability analysis of a system having constant hazard rate. 8

B The following data refers to a certain test of equipment 10

Failure No.	1	2	3	4	5	6	7	8
Operating time to failure(hrs)	18	12	08	22	26	35	30	40

Find out the reliability by
(i)Mean Method and
(ii)Median Method and compare the two by plotting.

OR

Q. 12 A Explain significance of "Safety margin "in engineering reliability design. 6

B Explain Accelerated life Testing for evaluation of reliability. 6

C The mean strength and standard deviation of a bolted joint are 3000 kgf/cm ^{2} and 300 kgf/cm ^{2} respectively. The joint is loaded such that stress induced has a mean valve of 2500 kgf/cm ^{2} with standard deviation of 50 kgf/cm ^{2}.Assuming that shear strength and the induced stresses are independent and normally distributed, find out the probability of survival of bolted joint. Statistical data is given below: 6

z	1.2	1.3	1.4	1.5	1.6	1.7	1.8
$\Phi(z)$	0.8849	0.9032	0.9192	0.9331	0.9452	0.9550	0.964

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

UNIVERSITY OF PUNE
[4364]-450
B. E.(Mechanical) Examination - 2013
CRYOGENIC ENGINEERING (OPEN ELECTIVE)
(402050) (2008 Course)

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

Instructions:

1 *Answer 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.*
4 *Neat diagrams must be drawn wherever necessary.*
5 *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator, P-h & T-S Charts is allowed.*
6 *Assume suitable data, if necessary.*

SECTION -I

Q.1	A)	Define Cryogenics. What is the temperature threshold distinguishing Cryogenics form Refrigeration and Air conditioning?	[4]
	B)	Mention the important landmarks in the field of the cryogenics.	[4]
	C)	State boiling points for the gases viz. Helium, Hydrogen, Nitrogen, Oxygen	[4]
	D)	State the effect of Cryogenic temperature on Yield strength of the material	[4]
		OR	
Q.2	A)	Explain how the mechanical properties like Ultimate strength, fatigue strength, Hardness & ductility behave at Cryogenic temperature.	[8]
	B)	Explain Debye Specific Heat function	[8]
Q. 3	A)	What are the system performance parameters in liquefaction system	[4]
	B)	Explain the Thermodynamically ideal liquefaction system.	[6]
	C)	Define Joule Thompson effect and explain inversion curve for isenthalpic expansion	[6]
		OR	
Q. 4	A)	Determine the ideal work requirement for liquefaction of Nitrogen gas beginning at 101.3 kPa and 300 K. h_1 = 462 kJ / kg at 101.3.s_1 = 4.42 kJ/kg K at 101.3 kPa and 300K h_f = 29kJ/kg at 101.3 kPa, s_f = 0.42 kJ/kg K and saturated liquid condition.	[6]
	B)	Draw a neat sketch of Simple Linde Hampson system and plot the	[10]

same on T-s Diagram. Derive the yield, work and FOM expression for the cycle.

Q. 5	A)	Explain Philips of Stirling refrigerator with line diagram and plot the cycle on T-s chart. Derive the expression for COP in Philips refrigerator	[8]
	B)	State the difference between Solvay refrigerator and Gifford Mac Mohan Refrigerator	[4]
	C)	Explain the use of solids as working media in Cryogenic refrigeration system.	[6]

OR

Q. 6	A)	Explain how a Cryogenic liquefaction system differs from Cryogenic refrigeration system with respect to desired output, performance parameters.	[6]
	B)	Explain the effect of regenerator effectiveness on system performance.	[6]
	C)	Explain working of Vuillemier refrigerator with neat sketch.	[6]

SECTION II

Q. 7	A)	Explain the thermo dynamically ideal separation system.	[8]
	B)	Explain the principle of rectification column.	[8]

OR

Q. 8	A)	Explain the theoretical plate calculations using McCabe-Thiele technique.	[8]
	B)	Write a short Note on need of Separation of gas mixture	[8]
Q. 9	A)	State and explain the principle and working of Platinum resistance thermometer	[8]
	B)	Explain different methods to measure the liquid level inside the Dewar vessel	[8]

OR

Q. 10	A)	Explain the different components of Dewar vessel.	[8]
	B)	Explain different insulations used in the field of Cryogenics in increasing order of performance.	[8]
Q.11	A)	Explain Meissner effect and phenomenon of superconductivity.	[6]
	B)	What are the different present day applications in the field of medical?	[6]
	C)	What are the different applications of Cryogenics in the field of Space Technology?	[6]

OR

Q. 12	A)	Explain any five applications of Cryogenics in the present day world.	[10]
	B)	Explain the cryogenics principle used in recycling of automobiles tyres.	[8]

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

UNIVERSITY OF PUNE
[4364]-451
B. E. (Mechanical)(Open Elective)Examination - 2013
PRODUCT LIFECYCLE MANAGEMENT(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. *Black figures to the right indicate full marks.*

SECTION -I
UNIT I

Q.1	A	Explain the stages of Product Life cycle in detail with suitable example.	8
	B	Explain different components of PLM	8
		OR	
Q.2	A	Discuss the customer involvement in the context of implementation of PLM.	8
	B	What do you mean by product lifecycle management? Discuss the concept with its significance.	8

UNIT II

Q. 3	A	What is the PLM Life Cycle Model? Explain all phases with suitable example	17
		OR	
Q. 4	A	What are different threads in PLM? Explain in detail.	17

UNIT III

Q. 5	A	Explain the role of Internal drivers in detail for implementing PLM.	17
		OR	
Q. 6	A	What are different external drivers demanding PLM implementation. Discuss in detail.	17

SECTION II

UNIT IV

Q. 7	A	Explain the reasons for deployment of the PLM system.	8
	B	Explain the PLM system in context with the Information model & product structure.	8
		OR	
Q. 8	A	Explain the functioning of PLM System.	8
	B	Explain the Product Information data model in detail.	8

UNIT V

Q. 9	A	What is the PLM Strategy? Explain the different aspects of PLM strategy in detail.	17
		OR	
Q. 10	A	Write a short note.	
		a) Product Data	6
		b) Product Workflow	5
		c) Link Between Product Data & Product Workflow	6

UNIT VI

Q. 11	A	Explain in detail different core functions of PLM? Elaborate with examples wherever necessary.	17
		OR	
Q. 12	A	What are different Product development processes & methodologies?	8
	B	Elaborate two examples of PLM in real life use in detail.	9