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

UNIVERSITY OF PUNE

[4364]-42

B. E. (Mechanical) Examination – 2013

(Power Plant Engineering)(Semester II)(2003 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.*
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	Explain with neat sketch the following ckts i)Air & Gas circuit ii) Cooling water circuit	8
	B	List & explain factors considered for selection of site for a hydroelectric power plant & steam power plant	8

OR

Q.2	A	Explain with neat sketch working of "CANDU Reactor"	8
	B	Write a short note on "Nuclear Power Development Programme of India"	8

UNIT-II

Q. 3	A	What are the major advantages of coal benefication? What is coal oil mixture? How it is prepared	8
	B	What is Boiler Draught? How draughts are classified? Explain in Details	8

OR

Q. 4	A	Explain with neat sketch "Fluidized Bed combustion system"	8
	B	State the good characteristics of a good ash handling plant. How dust collectors are classified?	8

UNIT-III

Q. 5	A	With a neat sketch explain working of a Velox Boiler. What are its merits & demerits?	9
	B	Explain in details principle of operation of "overfeed & underfeed stokers".	9

OR

Q. 6	A	Sketch a typical layout of a modern thermal power plant with	6

		superheat, reheating regenerative feed heating .Show on T-S diagram.	
	B	A steam power plant operates at a boiler pressure of 07 MPa & condenser pressure of 20kpa. Determine:- 1) Energy supplied/kg of stem produced in boiler 2) Quality of steam entering the condenser 3) Rankine cycle efficiency considering the pump work. 4) specific steam consumption	12

SECTION II

Q. 7	A	From first principles show that, the critical pressure ratio, $(P_2P_1)=(\frac{2}{r+1})^{(r/r-1)}$ where ‚r' is the adiabatic Index.	10
	B	Explain why a subsonic nozzle is convergent while a supersonic nozzle is divergent	6
		OR	
Q. 8	A	Write a short note on "types of condensers"	8
	B	What are the sources of airleakage in a condenser? Explain any one type of air pump	8
		UNIT-V	
Q. 9	A	Derive the expression for maximum blade efficiency of a reaction turbine.	8
	B	What is the necessity of compounding of steam turbines? Explain different methods of compounding	8
		OR	
Q. 10	A	Derive the expression for diagram efficiency of a reaction turbine and hence show that $(\eta max)=\left(\frac{2cos^2\propto}{1+cos^2\propto}\right)$, where $\propto$- blade Inletangle	8
	B	Derive an expression for optimum value of the ratio of blade speed to steam speed for maximum efficiency of a single stage impulse turbine.	8
		UNIT-VI	
Q. 11	A	Define:- (1) Load Factor (2) Maximum Demand (3) Average Demand (4) plant use factor (5) Plant capacity factor	10
	B	Write a short note on "Tariff methods"	8
		OR	
Q. 12	A	What are Base Load & Peak load plants, explain in details	6
	B	The daily Load for a power plant is given by the following equation: $L=350+10t-t^2$; Where ‚t' is time in hours from 0 to 24 hrs and ‚L' is load in MW. Draw the Load curve and load duration curve and calculate (1) Value of maximum load & when it occurs and (2) Plant Load Factor	12

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

UNIVERSITY OF PUNE

[4364]-37

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

Alternative Energy Sources (2003 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-Sheets****.*

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	What is solar constant? Discuss the reasons for variation of receiving in solar radiation reaching earth.	10
	B	Discuss the present energy scenario in India & government future strategy for the same.	8
		OR	
Q.2	A	Estimate declination, Hour angle & day length on a horizontal surface at Vadodara (22º00'N,73º10'E) during the month of March if the average sunshine hours per day is 9.5	8
	B	Define following solar terminology with neat sketch. i) Zenith angle ii) solar azimuth angle iii) Surface azimuth angle	10

Q. 3	A	Explain the working principle & material selection for different components of FPC. Discuss economy of utilization of FPC for domestic application.	8
	B	Which the different parameter that the performance of FPC? Explain them.	8
		OR	
Q. 4	A	Explain the standard Testing procedure for liquid flat plate collector & draw its performance curves.	8
	B	Enumerate various solar thermal applications & explain any one of them in detail.	8
Q. 5	A	List various types of solar stills. Explain with help of neat sketch any one type showing various energy transfer and approximate rang of efficiency and output.	8
	B	Solar drying is superior to traditional drying, explain in brief. Draw neat sketch of forced circulation dryer, explain its working.	8
		OR	
Q. 6	A	Explain with reasoning various materials used for construction of concentrators & reflecting surface.	8
	B	Write a short note on i) Chimney type solar dryer. ii) Passive solar heating for a residential building.	8
		SECTION II	
Q. 7	A	Discuss the industrial, social & consumer application of photovoltaic system.	8
	B	State the limitations of solar power conversion & explain with neat sketch any one solar power plant.	8
		OR	
Q. 8	A	Describe savonious type rotor for vertical axis wind turbine with neat sketch.	8
	B	Discuss the sizing & selection for micro hydel power plants.	8
Q. 9	A	What is fuel cell? How does it differ from storage battery? Explain any one type of fuel cell in detail.	8

	B	Discuss the suitability & scope of tidal power plants in India.	8
		OR	
Q. 10	A	Explain the neat sketch a closed cycle OTEC system	8
	B	Describe a typical geothermal field with a neat sketch. State the location of geothermal energy in India.	8
Q. 11	A	What is Gasifier? Describe updraft Gasifier with neat sketch.	6
	B	Which are the different methods for obtaining energy from biomass?	6
	C	Discuss the factors affecting the performance of bio-gas plant.	6
		OR	
Q. 12	A	Explain use of Bio-Gas as a diesel fuel	6
	B	Discuss the significance of Bio-Gas in rural India	6
	C	Write a note on ISO environment protection norms.	6

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

UNIVERSITY OF PUNE
[4364]-45
B. E. (*Mechanical*) Examination - 2013
Computational Fluid Dynamics
(2003 Course)(402050)

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

Instructions:

1 Answer 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 *Black figures to the right indicate full marks.*

4 *Your answer will be valued as a whole*

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 -I

Q.1 A Explain impact of CFD simulation technique on any two areas of engineering with suitable examples. 10

B Describe models of flow used for analyzing fluid flow problems or deriving the governing equations 6

OR

Q.2 A Obtain equation of momentum in differential from using suitable flow model. 10

B Write few comments on governing equations of fluid flow. 6

Q. 3 A Solve the system of equations 10

$u^1 = -3u+2v \quad u(o) = o$

$v^1 = 3u-4v \quad v(o) = ½$

with h = 0.2 on the interval 0 to 1

B What is adaptive stepping? 6

OR

Q. 4 A Solve the equations 8

$\frac{d^2y}{dx^2} - y^2 \frac{dy}{dx} = x$ subject to the condition at $x = 1, y = 2, \frac{dx}{dx} = 1$ & calculate $y \; at \; x = 1.2$ taking h = 0.2

	B	Discuss advantages & disadvantage of explicit & Implicit schemes.	8
Q. 5	A	Obtain different quotient for derivate $\frac{\partial^2 u}{\partial x^2}$ using Taylor series	8
	B	What is a consistent difference equation?	4
	C	What are the types of error in numerical analysis?	4
	D	Which method out for implicit & explicit is having better stability.	2
		OR	
Q. 6	A	What is artificial viscosity	8
	B	Give solution procedure for first order linear wave equation using suitable technique	10
		SECTION II	
Q. 7	A	Give solution algorithm for thermally developing flow inside a circulator pipe or 2D channel	12
	B	What is stability issue in numerical solution? Give stability criteria	6
		OR	
Q. 8	A	With Governing $ed^n \ \frac{\partial T}{\partial t} = \propto \left(\frac{\partial^2 T}{\partial x^2}\frac{\partial^2 T}{\partial x^2}\right) where \propto = k/scp$ on a 4× 4 2 dimensional grid, obtain the temperature of inside nodes after 10 seconds if the plate is kept at 100°C & the bottom boundary is at $30°C$. T surrounding = 25°, q = 8000 $w/m^2, h = 80w/m^2°C$ K = 15 $w/m°C, \ \propto = 3.2 \times 10^{-6} m^2/s$	12
	B	Give names of explicit, implicit & semi-implicit schemes each.	6
Q. 9		Give solution procedure of subsonic supersonic isentropic nozzle flow using McCormack technique	16
		OR	
Q. 10	A	Write features of Lax wendroff and McCormack technique explain one of these technique	12
	B	What are quasi 1 dimensional flows	4
Q. 11	A	Explain what is staggered grid?	6
	B	Give Introduction, features & disadvantages finite volume method	10
		OR	
Q. 12		Write short notes on an two of the following a. SIMPLE Algorithm b. MAC formation c. Stability considerations	16

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

UNIVERSITY OF PUNE
[4364]-46
B. E. (*Mechanical*) Examination - 2013
Energy Management
(2003 Course)(402050)

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

Instructions:

1 *Figure to the right indicate full marks*
2 *Solve questions 1 or 2,3 or 4,5 or 6 from section-I and 7 or 8,9 or 10, 11 or 12 from section-II*
3 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*
4 *Neat diagrams must be drawn wherever necessary.*
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	Discuss different aspects of energy policy and strategy in energy conservation systems?	8
	B	Explain strategic measures for meeting the future energy requirements if India.	8
		OR	
Q.2	A	Explain the need of renewable energy sources and importance of energy efficiency.	8
	B	Give energy consumption pattern of global and Indian industry.	8
Q. 3	A	Explain various instruments used for energy audit with neat sketch.	8
	B	What is a typical energy audit reporting format?	8
		OR	
Q. 4	A	Calculate net present value of 12% with an Investment of Rs. 60,000 at the beginning of the first year, & saving of Rs. 28,000 & 41000 at the end of the first & second year respectively	8
	B	What is time value of money and Net present Value?	8
Q. 5	A	Why excess air is required? Explain importance of flue gas monitoring in a boiler with reference to energy conservation and environmental protection.	10

	B	Describe a typical steam distribution systems and condensate recovery system in a process plant.	8

OR

Q. 6	A	What are steam straps? List various types of steam straps and explain any one. How the selection of steam is done?	10
	B	Explain energy conservation opportunities in compressed air system.	8

SECTION II

Q. 7	A	Explain various insulations materials and their desirable properties	8
	B	Explain energy conservation opportunities in electrical motors.	8

OR

Q. 8	A	List various types of lamps and explain energy efficient lamps.	8
	B	What is power Factor? Give various ways of improving it.	8
Q. 9	A	What is cogeneration? Explain need and importance of cogeneration system.	8
	B	Explain various flow control strategies.	6
	C	How does a plant Heat exchanger work? Give typical examples.	4

OR

Q. 10	A	Explain various energy conservation opportunities in pumping system.	8
	B	Define waste heat recovery? Explain various WHR systems.	6
	C	Explain Heat wheel with neat sketch.	4
Q. 11	A	Write various energy conservation opportunities in thermal power plant.	8
	B	Explain various energy conservation opportunities in pumps and fans.	8

OR

Q. 12 Write notes on($4 \times 4 = 16$) 16

i. Energy efficient illumination.
ii. Efficiency improvements of pumps.
iii. Energy conservation opportunities in refrigeration and air conditioning system.
iv. MD control

B.E. MECHANICAL

MECHANICAL SYSTEM DESIGN (402011)

(2003 COURSE)

TIME : 4 Hours **[Max Marks : 100]**

Instructions to the candidates:

1) *Answer three questions from 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) *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.*

Q.1) a) What is meant by pre-stressing of a cylinder? What is its necessity? Explain any one method of prestressing cylinder? [8]

b) A hydraulic cylinder with closed ends is subjected to an internal pressure of 15 MPa . The inner and outer diameters of the cylinder are 200mm and 240 mm respectively. The cylinder material is cast iron FG300.Determine the factor of safety used in design. If the cylinder pressure is further increased by 50%,What will be the factor of safety? [10]

OR

Q.2) a) A hydraulic cylinder made of Grey C.I. with 220 mm inside diameter is subjected to internal pressure of 18MPa.Using appropriate theory of failure find the required thickness of cylinder with factor of safety 2.0. [6]

b) Explain the various failure modes of pressure vessel. [6]

c) Derive Clavarino's equation. State its applications. [6]

Q.3) A shaft is to be used to transmit a torque of 1500 N-m. The required torsional stiffness of the shaft is 100 N-m/degree, while the factor of safety based on yield strength in shear is 2.0. Using the maximum shear stress theory, design the shaft with the objective of minimizing the weight, out of the following materials: [16]

Material	Weight Density w , N/ m^3	Tensile Yield strength Syt, N/ mm^2	Modulus of Rigidity G, N/ mm^2
Chromium steel	77×10^3	420	84×10^3
Plain carbon steel	76.5×10^3	230	84×10^3
Titanium alloy	44×10^3	900	42×10^3
Magnesium alloy	17.5×10^3	225	15×10^3

OR

Q.4) A simple tensile bar of length of 200mm is subjected to a constant force of 5000 N .If factor of safety is 3, Design a bar for minimum cost, out of the following materials. From the manufacturing considerations, the cross sectional area of the bar should not be less than 50 mm^2. [16]

Material	Mass density [Kg/m^3]	Material cost per unit mass c, [Rs/kg]	Yield Strength [N/mm^2]
Steel	7800	28	400
Aluminium alloy	2800	132	150
Magnesium alloy	1800	150	100
Titanium alloy	4500	2200	800

Q.5) a) Explain the terms giving examples.

I] Coefficient of fluctuation of speed

II] Maximum fluctuation of energy

III] Rimmed Flywheel [6]

b) The turning moment diagram of four stroke engine can be assumed to be consisting of four triangles. The areas measured are 750, 100, 80 and 200 mm^2 for Power, Exhaust, Suction and Compression strokes respectively. Scale chosen for plotting the diagram is 1 mm^2 = 10 J. The engine is running at 700 rpm and speed fluctuation is to be kept within 2% of mean speed. Wheel material is FG 150 (ρ =7000 Kg/m^3), use factor of safety as 5.Maximum size of flywheel is limited 2m. Assume Rim width to thickness ratio as 2. Assume that rim contributes 90% of the total required inertia. [12]

OR

Q.6) a) Derive expression for bending stress in flywheel arm due to torque transmission. [6]

b) The torque developed by an engine is given by following equation.

$T= 14250 + 2200 \sin 2\theta - 1800 \cos 2\theta$ Where, T is the torque in N-m and θ is the crank angle from inner dead centre position. The resisting torque of the machine is constant through the work cycle. The coefficient of speed fluctuations is 0.01. The engine speed is 150 rpm. A solid circular steel disk ,50 mm thick, is used as a flywheel. The mass density of steel is 7800 kg/m^3, calculate the diameter of the flywheel disk.

SECTION II

Q.7 Straight tensile bars of diameter 10±0.1 mm are made of plain carbon steel having tensile yield strength of 330±30 N/mm^2. The load on the bars is 23.5±5 KN .If the diameters,strengths and loads are normally distributed,estimate the reliability of the bars for withstanding the load. [18]

Z	1.3	1.4	1.5	1.6
AREA	0.4032	0.4192	0.4332	0.4452

OR

Q.8 a) Write a short note on: [12]

1) Design for casting, 2) Design principles in powder metallurgy.

b)Explain the basic principles of DFMA. [6]

Q.9 a) Find the speed steps arranged in geometric progression for the following conditions.

N_{min}=100 rpm; N_{max}=1800 rpm; Number of speed steps Z=8 . Alsodraw the best possible structure diagram for the same. [12]

b) Draw the sructural diagram for following sructural farmulae [4]

i] 3(1) 2(3) 2(6), ii] 2(1) 3(2)

OR

Q.10 a) Calculate the number of teeth on the gears on last shaft for multispeed gear bax having structural farmulae 3(1) 2(3) and speed steps as 120, 169.2, 238.57,336.39,474.3,668.77 rpm. Assuming all pinions to have 20 number of teeth and module of 5 mm . Take speed of motor = 770 rpm. [12]

b) Explain the term 'Maximum loss of economic cutting speed'. [4]

Q.11. a) What is the use of following in flat belt conveyor? [4]

1. Scraper, 2. Bend Pulleys , 3. Tension take up device and 4. Snub Pulley

b) An inclined belt conveyor with 20^0 inclination is to be used for transporting bulk material with specific weight 10000 N/m^3. Belt width is 1000 mm and belt speed is 2 m/s .If flow factor is 2.5 $\times 10^{-4}$, find out capacity of conveyor. [6]

c) Explain the capacity of conveyor in Tons/hr. [6]

OR

Q.12 a) What are the design considerations in selecting the belt speed of conveyor. [8]

b)What are different ergonomic considerations involved in the design of controls. [4]

c)Expain concept of containerization and design considerations [4]

UNIVERSITY OF PUNE

[4364]-32

B. E.(Mechanical/ Mech SW Engineering)Examination - 2013

DYNAMICS OF MACHINERY

(2003 Pattern)

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

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

Instructions

(1) Answer 03 from section I and 03from section II.

(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, electronics pocket calculator is allowed.

(5) Assume suitable data if necessary.

SECTION-I

UNIT-1

Q1 a) What do you understand by gyroscopic couple? Derive a formula for its magnitude. [6]

b) The turbine rotor of ship has a mass of 2000kg and rotates at the speed of 3000 r.p.m. clockwise when looking from a stern. The radius of gyration of a rotor is 0.5m. [10]

Determine the gyroscopic couple and its effect upon the ship when the ship is steering to the right in a curve of 100m radius at a speed of 16.1 knots

(1 knot=1855 m/hr).

Calculate also the torque and its effects when the ship is pitching with S.H.M., bow falling with its maximum velocity. The period of pitching is 50 seconds and the ship

pitches through total angle of 12°. Find the maximum acceleration during pitching motion.

OR

Q2 a) Define the following terms related to gyroscope with neat sketch. [8]

i) Axis of spin ii) Axis of couple iii) Axis of precession iv) Active And Reactive gyro. Couple.

b) Find the angle of inclination with respect to the vertical of a two wheeler taking a turn. Given: combined mass of the vehicle with its rider 250kg moment of inertia of the engine flywheel 0.3 kg-m^2, moment of inertia of each road wheel 1 kg-m^2 , speed of the engine flywheel 5 times that of the road wheels and in the same direction, height of centre of gravity of rider with vehicle 0.6m, two wheeler speed 90km/hr, wheel radius 300 mm, radius of turn 50m. [8]

UNIT-2

Q3 a) The firing order in a 6 cylinder vertical four stroke in-line engine is 1-4-2-6-3-5. the piston stroke is 100 mm. and length of each connecting rod is 200 mm. the pitch distances between cylinder centre lines are 100 mm, 100mm, 150 mm, 100mm, and 100mm respectively. The reciprocating mass per cylinder is 1kg and engine runs at 3000 r.p.m. [12]

Determine the out-of-balance primary and secondary forces and couples on this engine, taking a plane midway the cylinder 3 and 4 as the reference plane.

b) Explain 'direct and reverse crank' method for determining unbalanced forces in radial engines. [6]

OR

Q4 a) A,B,C and D are four masses carried by a rotating shaft at radii 100,125, 200 and 150mm respectively. The planes which the masses revolve are spaced 600mm apart and the masses B,C and D are 10kg, 5kg and 4kg respectively. Find the required mass 'A' angular position of 4 masses so that the shaft is in complete balance. [12]

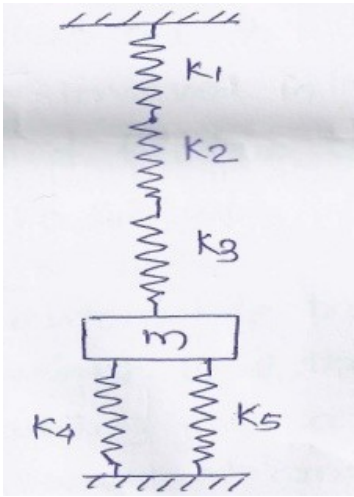
b) Explain the terms 'static balancing' and 'dynamic balancing'. State the necessary conditions to achieve them. [5]

UNIT-3

Q5 a) For the system shown [8]

K_1 = 2000 N/m, K_2 =1500 N/m, K_3 = 3000 N/m and K_4 = K_5 = 500 N/m

Find 'm' such that the system has a natural frequency 10Hz.



b) Discuss about viscous damping. For a vibratory system below find [8]

i) damping factor

ii) the natural frequency of damped vibrations

m=3kg, k=100 N/m, c= 3 N s/m

OR

Q6 a) A U-tube open to atmosphere at both ends contains a column length '*l*' of certain liquid. Find the natural period of oscillation of the liquid column [8]

b) The damped vibration record of spring-mass-damper system shows the following data

Amplitude of second cycle=1.2cm, Amplitude of third cycle=1.05 cm, spring constant, k= 7840 N/m, mass of spring M=2kg. determine damping constant. [8]

Q7 a) A system of beam supports a motor of mass 1200kg. the motor has an unbalanced mass 1 kg located at 6.0 cm radius. It is known that the resonance occurs at 2210 r.p.m. what amplitude of vibration can be expected at motor's operating speed of 1440 r.p.m. if damping factor is assumed to be less than 0.1? [8]

b) Investigate the terms involved in the equation of motion of one degree of freedom system as given by $5\ x'' + 3\ x' + 12x = 10 \sin wt$ [10]

OR

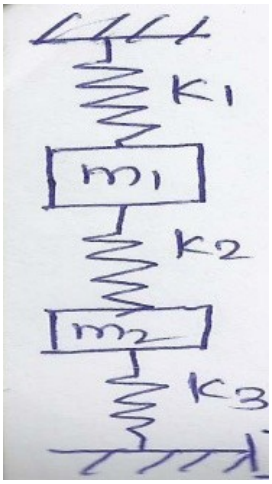
Q8 a) The springs of an automobile trailer are compressed 0.1 m under its own weight. Find the critical speed when the trailer is travelling over a road with profile approximated by a sine wave of amplitude 0.08 m and Wave length of 14 meters. What will be the amplitude of vibration at 60km/hour. [8]

b) A 1000 kg machine is mounted on four identical springs of total spring constant 'k' and having negligible damping. The machine is subjected to a harmonic external force of amplitude Fo=490 N and frequency 180 r.p.m. determine: The amplitude of motion of the machine and maximum force transmitted to the foundation because of unbalanced force when $k=1.96 \times 10^6$ N/m [10]

UNIT-5

Q9 a) What do you understand by a semi-definite system? Give two examples of semi definite system. [8]

b) A system is shown in fig.2. find the equation of motions of masses for the condition if $m_1 = m_2 = m = 9.8$ kg, if both the masses are displaced in downward direction and released, $k_1 = k_3 = 8820$ N/m, $k_2 = 3430$ N/m find the natural frequencies. [8]



OR

Q10 a) A shaft of 100 mm diameter and 1 metre long has one of its end fixed and other end carries a disc of mass 500 kg and radius of gyration of 450 mm. modulus of rigidily for the shaft material is 80 GN/m^2 . determine the frequency of torsional vibrations and mode. [8]

b) Establish the expression to determine the frequency of torsional vibrations of a geared system. [8]

UNIT-6

Q11 a) Explain with neat diagrams any two of the following [8]

i) Frequency measuring instruments

ii) Velocity pick-ups

iii) Accelerometers.

b) A vibrometer has a period of free vibrations of 2 seconds. It is attached to a machine with a vertical harmonic frequency of 1 Hz. If the vibrometer mass has an amplitude of 2.5 mm relative to the vibrometer frame. What is the amplitude of vibration of machine? [8]

OR

Q12 a) Explain the term critical speed of shaft. Derive an expression for the same [8]

b) Determine the mass M to be placed at the end of reeds of Frahm tachometer in order that the reed be in resonance at a frequency of 1800 cycles/min. the steel reed is 50mm long, 6 mm wide and 0.75 mm thick. Young's modulus of the material of the reed is 19.6×10^{10} N/m^2 . [8]

UNIVERSITY OF PUNE

[4364-33]

B.E. (Mechanical) Examination-2013

Mechatronics

(2003 pattern)

Time-Three hours **Maximum Marks-100**

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

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 whenever necessary.

(4)Use of Scientific calculator is allowed.

(5)Assume suitable data wherever necessary but mention it clearly.

SECTION-I

Q.1 (a)Describe three stages of measurement system with Borden tube pressure guage as an example. (9)

(b)Compare Venturimeter and Orificemeter with respect to construction , advantages ,limitations and applications. (9)

OR

Q.2 (a)With respect to construction,working, advantages and applications discuss Rotameter as flow measuring device. (9)

(b)Define any four static characteristics of measuring instruments. (9)

Q.3 (a)Discuss any two level measurement devices with respect to construction and applications. (8)

(b)With respect to principle,construction,ranges,sensitivity and applications of RTD as temperature measuring transducer. (8)

OR

Q.4 (a)Define Gauge factor of strain guages.Discuss two applications of strain guages as force measuring transducers.

(8)

(b)Write a short note on absolute and incremental Encoders for measurement of angle.

(8)

Q.5 (a)discuss mathematical model of Resistance,inductance and Capacitance connected in parallel.Obatin transfer function of this arrangement with voltage as input and current as output.

(8)

(b)Compare open loop and closed loop control system with respect to definition,block diagram,and one application each.

(8)

OR

Q.6 (a)Obtain a mathematical model of mass,spring and damper connected in parallel.Write the transfer function with force as input and displacement as output.

(8)

(b)Discuss the domestic water heater (geezer)as closed loop control system.Draw the block diagram and identify the feed-forward and feed-back elements. (8)

SECTION-I

Q.7 (a)Discuss the response of first order control system to a step input and impulse input.

(8)

(b)Write a short note on electromagnetic relay with respect to schematic construction,terminals,operations and applications.

(8)

OR

Q.8 (a)Compare proportional plus integral controller and Proportional plus derivative controller with respect to mathematical equation,advantage over proportional controller and one limitation each.

(8)

(b)Discuss the response of second order control system to step input with respect to percentage overshoot,damping,setting time and un-damped natural frequency.

(8)

Q.9 (a)Draw the circuit diagram describing operational amplifier as summing amplifier and differentiator. Write mathematical equation of each

configuration along with description.
(8)

(b)Explain role of voltage divider and Wheatstone's bridge in signal conditioning.
(8)

OR

Q.10 (a)Explain role of operational amplifiers in signal conditioning. (8)
(b)Write a short note on Analog to Digital Converters.
(8)

Q.11 (a)Compare On-delayed and off-delayed timers in PLC programming with respect to symbol,timing diagram and one application each. (9)
(b)What is the need of latching in ladder programming?Explain START button programming as latching example.How the latched rung is de-latched? (9)

OR

Q.12 (a)Explain with symbol,specifications and one application each count up timers and Count down timers used in PLC programming. (9)
(b)With respect to construction,digital equations and symbols used .Explain a rung in ladder program with two suitable examples. (9)

UNIVERSITY OF PUNE

[4364]-34

B. E. (MECH) Examination – 2013

Gas Turbines and Jet Propulsion

BE Mech (2003 Course)

[Total No. of Questions:8] **[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.*
5) *Use oflogarithmic tables, slide rule, Molliercharts, electronic pocket calculator and steam tables is allowed.*
6) *Assume suitable data, if necessary.*

SECTION - I

Q.1 a) What do you understand by sonic velocity? Derive the relation for sonic velocity in terms of temperature and specific heat ratio. [6]

b) Define the following terms [10]

i) Mach number. ii) Mach cone. iii) Mach angle.

iv) Stagnation Temperature. v) Stagnation pressure ratio

Q.2 a) What is nozzle? What are the types of nozzles? How do you decided these types? Derive the equation which governs the shape of the nozzle. [8]

b) Write in short- i) Fanno flow and Fanno lines [8]

ii) Rayleigh lines.

Q. 3a) What do you understand by 'Degree of Reaction' in axial compressor? Drive the relation for the same. [8]

b) The following data refers to a test on axial flow compressor: Ambient pressure and temperature at inlet are 1 bar and 18^0C. Total head pressure and [8]

temperature in the delivery pipe are 3.5 bar and 165^0C. Static pressure in the delivery pipe is 3 bar. Determine :-

i) Total head isentropic efficiency.

ii) Air velocity at the delivery pipe.

Q.4 a) Classify the gas turbines and explain the working of constant pressure, open cycle gas turbine with the help of T-S diagram. [10]

b) What are the assumptions made for ideal cycle analysis [8]

SECTION – II

Q.5 a) A single row impulse turbine has a mean blade speed of 215 m/s. Nozzle angle is 60^0 to the axial direction. The gas velocity from the nozzle is 550 m/s. there is 15% loss of relative velocity due to friction across the blades. The discharge of the gas form the turbine is axial. The gas flow through the turbine is at the rate of 700kg/ hour. Determine :- [10]

i) Inlet and exit angles of the moving blades.

ii) The absolute velocity of the gas at the exit.

iii) Power output.

Q.5 b) Write the effect of inter cooling & re-heating on Brayton Cycle. [8]

Q.6 a) for a 50% reaction turbine, prove that maximum work is V_b where V_b is the mean blade speed. Also prove that $n_{max} = \frac{2\,sin^2 a_1}{1+sin^2 a_1}$, where a_1 is is nozzle angle with respect to the direction of flow. [10]

b) Explain ideal turbojet cycle with the help of T-S diagram [6]

Q.7) Write short notes on : [16]

a) Fuels used in gas turbines

b) Pollution from gas turbines

c) Combustion theory in gas turbines

d) Combustion chambers in gas turbines

Q.8 a) What are the factors that are considered while selecting the materials for gas turbine components? [8]

b) Why gas turbine blades need cooling? Explain different methods used for blade cooling. [8]

UNIVERSITY OF PUNE
[4364]-38
B. E. (MECHANICAL) Examination 2013
KINEMATIC ANALYSIS & SYNTHESIS(402045)
(2003 Pattern)

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

Instructions :

(1) *Answers to the two Sections should be written in separate answer-books*
(2) *Neat diagram must be drawn wherever necessary.*
(3) Figures to the right indicate full marks.
(4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

SECTION I

Q.1a) Explain the term 'Mechanical Advantage'. Obtain an expression for mechanical advantage stating the assumptions made. if any [8]

b) Explain the concepts with suitable examples: [8]

i) Kinematic Inversions

ii) Equivalent Mechanisms.

OR

Q.2a) Discuss the concept of transmission angle of an index of performance of a four bar linkage. [8]

b) Explain the following terms: [8]

i) Kinematic pair

ii) Lower pair

iii) Higher pair

Give at least 2 examples of lower and higher pair, stating type of relative motion allowed by each of these.

Q.3a) Explain the complex algebra method for displacement, velocity and acceleration analysis of a crank and slotted lever quick return mechanism, with crank as the input. Explain how the resulting equations are solved. [10]

b) Explain degree of complexity of a mechanism giving examples. [6]

OR

Q.4a) Explain the 'auxiliary point method' for the kinematic analysis of a mechanism with low degree of such a mechanism. Draw neat sketches. [10]

b) State and explain Freudenstein's theorem. [6]

OR

Q.5a) Explain with neat sketch, Hartman's construction for drawing Inflection circle for motion of connecting rod with respect to frame in a slider crank mechanism. Show all the construction lines. [12]

b) State any two forms of Euler – Savary equation and discuss their Significance [6]

Q.6a) Write short note on any Two: [12]

i) Ball's point and its uses.

ii) Cubic of stationary curvature.

iii) Cusp points.

b) State any two forms of Euler-savary equation and discuss their significance. [6]

SECTION II

Q.7a) synthesize a 4 bar function generator to generate a function y= sin x in the interval $0^0 \leq x \leq 90^0$. The range of the output crank may be chosen as 60^0 while that of input crank be 120^0 consider three precision points with chebychev spacing . Length of fixed link =52.5 mm and starting [16]

positions of input & output links are respectively 105^0 and 65^0.

synthesize using pole method.

OR

Q.8a) Describe a graphical method to synthesize a slider crank mechanism when two successive rotations ϕ_{12} &ϕ_{23} of the crank are to be coordinated with two successive linear displacements s_{12} and s_{23} of the slider. [8]

b) Write note on [8]

i) Branch and order defect.

ii) Stages of kinematic synthesis.

Q.9a) Synthesize a 4 bar linkage using Freudenstein's equation such that the input and output angles are coordinated as given in the table- [8]

Input crank angle:	30^0	50^0	80^0
Output link angle:	0^0	30^0	60^0

b) State and prove Robert- chebychev theorem. [8]

OR

Q.10a) Synthesize a four bar linkage using complex number method, that will in one of its position, satisfy the following values for the angular velocities and accelerations. [12]

$\omega_1 = 20$ rad /sec $\quad \propto_1 = 0$

$\omega_2 = 08$ rad/ sec $\quad \propto_2 = 100$ rad/ sec^2

$\omega_3 = 10$ rad/ sec $\quad \propto_3 = -150$ rad/sec^2

The subscripts 1, 2 and 3 represent the input link, the coupler and the output link respectively The length of the input link is to be unity.

b) Explain Double Points and symmetry of a coupler curve. [4]

Q.11a) Discuss the concept of Denavit – Hartenberg parameters and their [12]

use in the study of spatial mechanism. Explain with suitable example. Draw neat sketch of indicate D-H parameters for a pair of links.

b) Write a note on – Eulerian angles [6]

OR

Q.12a) Obtain an expression for the transformation matrix relating two cartesian frames which are translated and rotated with respect to each other. Briefly explain the matrix method of displacement analysis of spatial mechanism. Thus obtain displacement relationship for Hooke's joint [18]

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

[Total No. of Pages : 5

B.E. (Mechanical)
OPERATIONS RESEARCH
(2003 Pattern) (Elective - I) (Semester - I)

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

Instructions to the candidates :

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

SECTION I

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

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

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

OR

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

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

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

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

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

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

Plan the production programme so as to maximize the profit. The company may have its production capacity at both plants partly or wholly unused. [08]

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

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

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

OR

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

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

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

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

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

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

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

OR

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

is allocated various number of boxes.

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

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

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

SECTION II

Q7) a) Solve the following game:

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

[08]

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

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

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

OR

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

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

[08]

b) A machine costs Rs. 500.operation and maintenance costs are zero for the first year and increase by Rs. 100 every year. If money is worth 5 % every year, determine the best age at which the machine should be replaced. The resale value of the machine is negligibly small. What is the weighted average cost of owning and operating machine? [08]

Q9) a) Repairing a certain type of machine which breaks down in given factory consists of 5 basic steps that must be performed sequentially. The time taken to perform each of the steps is found to have an exponential distribution with mean 5 minutes and is independent of other steps. If these machines break down in a

Poisson fashion at an average rate of two per hour and if there is only one repairman, what is the average idle time for each machine that has broken down? [08]

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

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

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

OR

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

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

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

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

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

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

OR

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

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

c) Draw a network for the following project and number the events according to Fulkerson's rule.
A is start event and K is the end event,
A precedes event B,
J is the successor event to F,

C and D are Successor events to B,
D is the preceding event to C,
E precedes F,
C restraints the occurrence of G and G precedes H,
H precedes J and K succeeds J,
F restraints the occurrence of H.

[06]

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

UNIVERSITY OF PUNE
[4364]-41
B.E.(Mechanical and Mechanical S/W) Examination-2013
CAD/CAM & Automation
(2003 Course)

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

Instructio

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

SECTION -I

Q.1 A. Given point P= (8, 9,- 6) & using the homogeneous representation calculate P*, if P is translated by d=2i + j −5k & then scaled uniformly by s=1.7. (6)

B. What is geometric mapping? What are the different applications of it? (5)

C What is the significance of homogeneous co-ordinates in geometric transformations? (5)

OR

Q.2 A Explain translational and rotational mapping with suitable examples. (6)

B Derive the concatenated transformation matrix for mirroring about line y =mx + c (10)

Q.3 A. Derive the equation for parametric equation of a circle. (8)

B. Explain the following term with respective to surface modeling (4)
i) Tabulated surface
ii) Revolved surface

C. Write a short note on “Order of continuity”. (4)

OR

Q.4 A. Distinguish between synthetic curves and analytical curves. (4)

B. The end points for line L1 are P1 (2, 3, 5) and P2 (-4,6,2). The end points for line L2 are P3 (-5,8,9) and P4 (1,-11,2) (8)
i) Find parametric equation of the lines.

ii) Are the two lines parallel of perpendicular?
iii) Find the coordinates of the intersecting point.

C. Explain different solid manipulations and its importance. (4)

Q.5 A. What are the properties of stiffness matrix? (4)

B. Write a note on linear shape function for 1 D element. (4)

C. 3 bar truss shown in Fig. 1. Find nodal displacements, support reactions and elemental stresses. Cross sectional area of each element is 1000mm^2. (10)
Take E = 200GPa

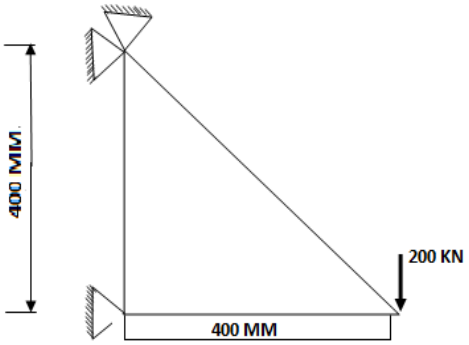


Fig . 1

OR

Q.6 A. Derive an expression for the element stiffness matrix of two nodded truss element. Also show element stress calculations. (10)

B. Explain with suitable examples the plane stress and plane strain conditions. (8)

SECTION II

Q.7 A. A constant strain triangle element is defined by three nodes at (2.6, 1), (8.8, 6) & (5, 9). Evaluate the functions N1, N2 & N3 at the interior point P (5.5, 4). Also determine the Jacobian of the transformation J. (8)

B. Explain shape function of CST element. Also explain the physical representation by area coordinates. (8)

OR

Q.8 A. Discuss the problem Modeling and Boundary Conditions for the following cases: (8)
a) a cylinder of infinite length subjected to external pressure.
b) Belleville spring.

B. Explain how symmetry is used in FEA with application. (8)

Q.9 A. Compare NC, CNC & DNC. What are the advantages of combining CNC & DNC? (4)

B. What is a canned cycle? Explain with suitable example. (4)

C. Write a manual part program for finishing forges components as shown in the Fig. 2. Assume the speed & feed on the turning center as 670 rpm & 0.26mm/rev. assume 1mm material is to be removed radially from external diameter. (8)

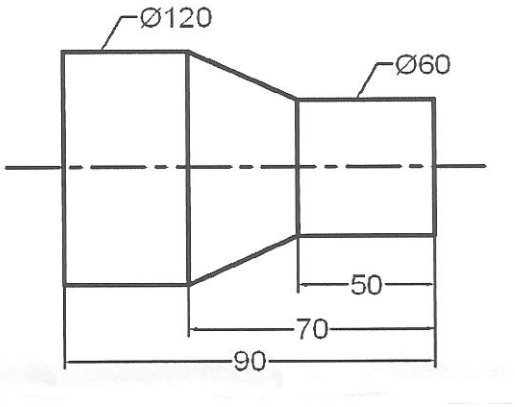


Fig. 2.

OR

Q.10 A. What are various activities of a manufacturing plant which can be carried out through computer control? (6)

B. Write a manual part program for turning a raw bar of Φ80mm & 65mm long as per the drawing using canned cycles. (10)

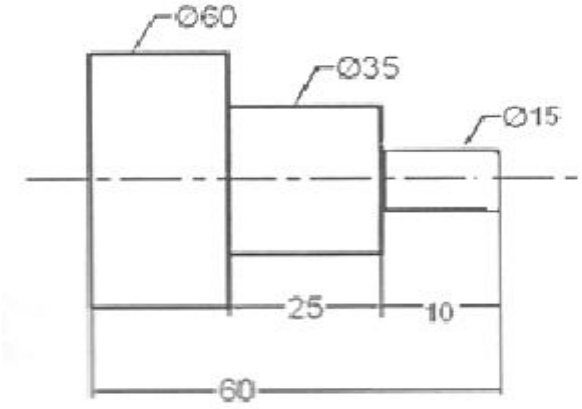


Fig. 3.

Q.11 A. What is a FMS? How does FMS ensure flexibility in manufacturing? (6)

B. Write a short note on Robot Programming. (6)

C. What are the different types of drives used in Robot? (6)

OR

Q.12 A. What are the Advantages & Limitations of Automation? (6)

B. Briefly describe significant application area of Robot. (6)

C. Write a short note on Types of Mechanisms for Gripper. (6)

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

UNIVERSITY OF PUNE

[4364]-43

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

Industrial Fluid Power (2003 Course)

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

Instructions:

1 ***Answer 03 Que. from Section I and 03 Que. from Section II***

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, electronic pocket calculator and steam tables is allowed.*

6 *Assume suitable data, if necessary.*

SECTION -I

Q.1	A	Write in brief on pressure line filters.	06
	B	Write in brief on sources of contamination and contamination control.	06
	C	Explain different of seal used in hydraulic systems.	06
		OR	
Q.2	A	What are the different factors considered for selection of hydraulic fluids?	06
	B	Explain difference between flared fitting and compression fitting.	06
	C	What are the different types of hydraulic fluids? Explain in detail.	06
Q. 3	A	Explain with the help of neat sketch working of balanced vane pump and also plot its characteristics.	08
	B	Explain the types of accumulators used in hydraulic systems.	08
		OR	
Q. 4	A	Explain with a neat sketch working of radial piston pump. Sketch its typical characteristic. Define different efficiencies of radial piston pump.	06

	B	A pump has a displacement volume of 98.4cm^3. It delivers 0.00152m^3/s of oil at 1000 rpm and 70 bar pressure. If the prime mover input torque is 124.3 N-m, find the overall efficiency of the pump and theoretical torque required to operate the pump.	10
Q. 5	A	Draw the graphical symbols for following: 1. Pressure intensifier 2. Shuttle value 3. Pressure relief valve 4. Fixed displacement bidirectional hydraulic motor	06
	B	How does an unloading valve differ from a sequence valve in mechanical construction?	06
	C	Explain the different methods of DCV actuation.	04
		OR	
Q. 6		Write note a following: (any two) i. Sequence valve ii. Pressure compensated flow control valve iii. Pilot operated check valve iv. Counter balance valve	16
		SECTION II	
Q. 7	A	Classify different hydraulic actuators. What are their typical applications?	08
	B	Explain the cushioning of cylinder with a neat sketch.	06
	C	What is a rod less cylinder and tandem cylinder? State their applications.	04
		OR	
Q. 8	A	Explain with a neat sketch the construction and working of a typical hydraulic cylinder.	06
	B	What factors will you consider in selecting a hydraulic motor? Mention two allocations of usages of hydraulic motor with their types.	06
	C	Name four important mountings in hydraulic cylinder with sketches.	06
Q. 9	A	Draw typical circuit of different speed regulating methods used in pneumatics circuits.	08
	B	Draw net sketch of a typical 3 way 2 position directional control valve used in pneumatic control circuit. Explain its	08

working in short.

OR

Q. 10	A	What are the advantages of an air motor over electric motor and hydraulic motor?	04
	B	What is the purpose of providing filter, lubricator, muffler and driers in pneumatic systems?	06
	C	Compare characteristics of hydraulic and pneumatic systems.	06
Q. 11	A	A double acting cylinder has a piston diameter of 5cm and a rod diameter of 2cm. The piston stroke is 20cm a. If oil is supplied to either end of the cylinder at a pressure of 70 bar and a flow of 12L/min, calculate the force that can be developed and time of travel (in seconds) during extension and reaction. b. Briefly explain why the forces and speed are different during extension and retraction. c. Show whether the power developed is the same or different during extension and retraction. Use your values of force and time.	16

OR

Q. 12	A	Hydraulic actuator is used to operate a machine. The load during first 80cm stroke out of the 1m stroke is 35kN. The speed is required to be about 20m/min. Load increases to 45kN for the remaining part of the stroke and the speed is required to be 8m/min. The return load is 20kN and the speed is to be limited to 25m/min. Draw hydraulic circuit to achieve this. Specify rating of different components used in this system.	16

DATA

1. Suction Strainer :

Model	Flow Capacity (/pm)
S_1	38
S_2	76
S_3	152

2. Pressure Gauge :

Model	Range (bar)
PG_1	0 - 25
PG_2	0 - 40
PG_3	0 -100
PG_4	0 - 160

3. Vane Pump :

Model	Delivery in / pm		
	at 0 bar	at 35 bar	at 70 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	11.4	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	0-24.6

6. Directional Control Valve :

Model	Max working Pressure (bar)	Flow Capacity (/pm)
D_1	350	19
D_2	210	38
D_3	210	76

7. Check Valve :

Model	Max working Pressure (bar)	Flow Capacity (/pm)
C_1	210	15.2
C_2	210	30.4
C_3	210	76

8. Pilot Operated Check Valve :

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 dia. (mm.)	Rod dia (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

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

UNIVERSITY OF PUNE
[4364]-44
B. E. (Mech.) Examination - 2013
ROBOTICS
(2003 Course)

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

Instructions:

1 *Answer **3 Q** from **Section I** and **3 Q** from **Section II***
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 electronic pocket calculator is allowed.*
6 *Assume suitable data, if necessary.*

SECTION -I

Q.1	A	Explain why homogenous coordinates are required in modeling of robotics manipulators.	08
	B	A Robot is less accurate but has good repeatability; another robot is accurate but poor repeatability. Which robot you will select for- 1. Spray painting operations 2. Spot welding operations. Justify your answers.	08
		OR	
Q.2	A	Explain D-H Parameters	08
	B	A frame {U V W} is located at a point P(20,25,18) with respect to {X Y Z}having axis U opposite to Z axis, axis X parallel to V axis. Both frames are right handed. Determine location of point Q which is ^{xyz}Q =(10,25,30).	08
Q. 3	A	Explain the factors on which the number of solutions to given inverse kinematic model depends.	08
	B	Explain the relationship between industrial automation and robotics.	08
		OR	
Q. 4	A	Explain Kinematics of SCARA manipulator.	08

	B	Sketch the approximate reachable workspace of the tip of a two link planar arm with revolute joints. For this arm the first link is twice as long as the second link and the joint limits are $60^o<\theta_1<180^o$ and $-80^o<\theta_2<160^o$	08
Q. 5	A	Classify the robots to physical configuration and explain any one in detail.	09
	B	Explain Industrial robot control systems.	09
		OR	
Q. 6	A	What are the major differences between the open-loop and close-loop servo systems?	09
	B	Explain the term Work volume, Spatial and control resolution related to the robots.	09
		SECTION II	
Q. 7	A	Explain hydraulic grippers with applications.	06
	B	Discuss various considerations for selection of a gripper.	06
	C	Explain need for sensors and vision system in the working and control of a robot.	06
		OR	
Q. 8	A	Write short note on, Characteristics of sensing devices.	06
	B	What is compliance? Explain active and passive compliance in brief.	06
	C	A vacuum gripper is used to lift flat steel plate of dimensions 20mm x 400mm x 600mm. The gripper used to suction cup, 110mm in diameter each, and they are located 400mm apart for stability. Assume a factor of safety of 1.5 to allow for acceleration of the plate. Determine the negative pressure required to lift the plates if the density of steel is $8054.3 \times 10^{-9} kg/mm^3$.	06
Q. 9	A	Explain different factors to be considered while selecting the sensors for robot applications.	06
	B	Write a note on redundant Robot.	04
	C	Explain use of robot in arc welding.	06
		OR	
Q. 10	A	Explain different types of speed reduction & transmission systems used in robots.	06
	B	Explain use of robot in the Assembling.	04
	C	Write various technical features required of robot for spray coating applications.	06

Q. 11	A	Explain various performance characteristics of induction motors.	06
	B	Explain Artificial Intelligence system used in Robots.	06
	C	Compare hydraulic & electrical actuator based on weight, resolution, operating pressure and cost.	04

OR

Q. 12	A	Discuss different methods used to enter the programming command into the controller memory.	06
	B	Explain generations of robot programming languages.	04
	C	Explain MOVE, OPEN, SIGNAL command with suitable examples.	06

[Total No. of Questions: 10] **[Total No. of Printed Pages: 2]**

UNIVERSITY OF PUNE
[4364]-47
B. E. (Mechanical Engineering)Examination - 2013
RAPID PROTOTYPING (402050)
(2003 Course)

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

Instructions:

1 *Solve any three questions from each Section*
2 *Answers to the two sections should be written in separate answer-books.*
3 *Figures to the right indicate full marks.*
4 *Neat diagrams must be drawn wherever necessary.*
5 *Assume suitable data, if necessary.*

SECTION -I

Q.1 A) What are the requirements of New Production Development Strategies? State the reason for the failure of a new product [8]

B) Describe the five steps involved in a general RP process with sketch. Which steps do you think likely to be altered? [8]

Q.2 A) How can bringing a product to market rapidly have an impact on the rate of return and how it affects the outcome of other competitive products? Elaborate with a example [8]

B) Explain typical data flow RP with flow-chart and state various data inputs. [8]

Q. 3 A) Classify RP systems on the basis of initial material from list five names of each and discuss their merits and demerits. [8]

B) Explain with neat sketch 3D Printing process in consideration of Z Corporation's 3D Printer. [8]

Q. 4 A) Explain with neat sketch SGC process, its applications and limitations [8]

B) Explain the method of layer projection with laser and without laser with neat sketch. Also give examples of each type. [8]

Q. 5 A) Write Short notes. (Any three) [18]

a) Simultaneous Engineering
b) Laser Sintering Process
c) FDM
d) LLM Technology and its applications.

SECTION II

Q. 6 A) Explain the process of precision casting using SL models [8]

B) What are the major difference between creating a prototype on a rapid prototype machine and creating one on a CNC machine? [8]

Q. 7 A) What is meant by RTV? Describe how it works with figures. [8]

B) Explain in details types of model makers materials with physical, mechanical, thermal and electrical properties. [8]

Q. 8 A) Explain with sketch Multi Component Metal Powder Laser Sintering process [8]

B) Name four areas of RP applications in medical field and briefly describe how RP technology is improving each area? [8]

Q. 9 A) What are the latest trends in RP material development RP process development? [8]

B) What are the important factors influencing the cost of RP process? Elaborate with suitable example. [8]

Q. 10 A) Write Short notes. (Any three) [18]

a) Criteria for evaluating a type of RP process with a case study.
b) Make of Buy decision in RP
c) RT
d) DSPC

[Total No. of Questions: 08] **[Total No. of Printed Pages:2]**

UNIVERSITY OF PUNE
[4364]-48
B. E. (Mechanical) Examination - 2013
RELIABILITY NGINEERING (402050)
(ELECTIVE-II) (2003 Course)

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

Instructions:

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

SECTION -I

Q.1 A Explain 6
i) Reliability
ii) Hazard Rate
iii) MTTF

B State the probability distributions in reliability evaluation. Explain any two 10

Q.2 A Evaluate failure density, Hazard rate, and reliability. Plot these functions against time. 10

Operating Hrs.	0	1	2	3	4	5	6	7	8
No. of failures	0	330	210	130	85	75	70	70	60

B State and explain central limit theorem with suitable examples. 6

Q. 3 A Determine the probability of success of the series parallel system, shown in Fig. No. 1 Given $P_A = P_B = P_C = 75\%$ and $P_D = 80\%$ 8

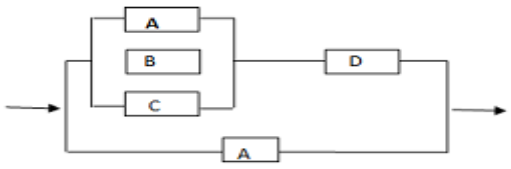


Fig. No .1

B Explain Bath-Tub curve with reference to failure mode 8

Q. 4 A Write Short note of the following **(Any two)** 18

1) Bay's Theorem
2) Quality and Reliability
3) Cut set and tie set method

SECTION – II

Q. 5	A	Explain with sketch Fault tree analysis and its construction	8
	B	Discuss in brief about system reliability analysis	8
Q. 6	A	Explain accelerated life testing method in detail.	8
	B	Explain the types loads considered in designing machines and structures.	8
Q. 7	A	Explain reliability testing with suitable examples.	8
	B	Explain the Failure mode and effect analysis (FEMA) Process.	8
Q. 8	A	Write short note of the following **(Any Two)**	18

1) Agree method.
2) Maintainability and availability
3) TQM

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

UNIVERSITY OF PUNE
[4364]-49
B. E. (MECHANICAL) Examination - 2013
AUTOMOBILE ENGINEERING (ELECTIVE-II)
(2003 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 *Figure 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) What are vehicle specifications? Give classification of vehicle and chassis. [6]

b) What is the function of a car frame? Sketch and explain the construction of a typical passenger car frame. [10]

OR

Q.2 a) What alternative positions may the engine occupy in a vehicle? State why it is fitted at the front on the majority of vehicles. [6]

b) Draw a net simple sketch of automobile indicating major components of it and explain the function of each. [10]

Q. 3 a) Why transmission assembly is essential in an automobile? [8]

b) Explain the construction and working of torque converter [8]

OR

Q. 4 a) Explain the construction and working of synchromesh gear box with the help of a net sketch. [8]

b) Explain with the help of neat sketch construction and working of overdrive system used in automotive transmission system. [8]

Q.5 a) What are the objectives of suspension system? What are the principles of suspension system design? Explain with neat sketch working of leaf [9]

spring.

b) Explain the air suspension system with a neat sketch. [9]

OR

Q.6 a) Explain briefly how hydraulic shock absorber act to reduce car tossing and car rolling. [9]

b) How does rigid axle front wheel suspension differ from independent front wheel suspension? [9]

SECTION-II

Q.7 a) Differentiate between tubed and tubeless tyre? [4]

b) What are the different types of wheels? Discuss there relative merits [4]

c) Discuss front end geometry including caster, camber, toe, steering axis inclination. [8]

OR

Q.8 a) What are the requirements of a good steering system? What do you understand by the term: over steer, under steer, cornering power and slip angle? [10]

b) Discuss a steering linkage for a vehicle with independent suspension. [6]

Q.9 a) What is function of differential in automobile? What is differential lock? State its merits and demerits. [8]

b) Explain the fully floating axial with the help of neat sketch. [8]

OR

Q.10 a) Explain with the help of net sketch Hotchkiss drive. [8]

b) What is the necessity of a universal joint in the car. Explain it's working with the help of neat sketch. [8]

Q.11 a) Describe construction and working of anti-lock braking system. [6]

b) How dose 'Folo-Thru' Bendix drive differs in construction and operation from the standard Bendix drive. [6]

c) Write note on dash board instrumentation. [6]

OR

Q.12 a) Write short note on the following (any Three) [18]

i) Power brakes
ii) Disc brakes
iii) Preventive maintenance
iv) Charging system