UNIVERSITY OF PUNE
[4364]-54
B. E. (*Mechanical S/W*) Examination - 2013
Tribology (2003 Course)

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

Instructions:

    1 ***Answer 3 Que from Section I and 3 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, Mollier charts, electronic pocket calculator and steam tables is allowed.*

    6 *Assume suitable data, if necessary.*

SECTION -I

Q.1   A Write a short note on- Tribodesign.   06

        B What are the different parameters which affect viscosity of oil? Discuss in brief.   06

        C State physical & chemical Properties of lubricants?   04

OR

Q.2   A Explain modes of lubrication?   06

        B What is role of additives in lubrication? What are different additives used in lubrication oils?   04

        C State and explain applications and importance of tribology in industries.   06

Q. 3   A Using the Bowden and tabor's theory of simple adhesion prove that coefficient friction due to adhesion is-   10

$$f_a = \frac{kS_{sy}}{S_{yc}} \ and \ f_a = 0.1667 \ for \ k = 0.5$$

        B Discuss the effect of following on coefficient of friction between two surfaces-   06
            1. Surface finish

2. Sliding velocity

OR

Q. 4 A Show that the volume of abrasive wear per unit sliding distance with conical abrasive particles is given by-   10

$$Q = [\frac{2k_w \cot \propto}{\pi}]\frac{W}{P}$$

B Write a short note on Delamination Wear.   06

Q. 5 A Derive the Reynold's equation. State the assumptions mode in the equation. Show the axial and radial pressure distribution in the bearing.   18

OR

Q. 6 A Following data is given for hydrodynamic full journal bearing   18

Radial load of	=5kN
Journal speed	1440 r.p.m
Viscosity of lubricating oil	=30 m Pa s
Unit bearing pressure	1000k Pa
Clearance ratio (r/c)	=800
Intel temperate	=40 C

Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing. Use given data in table no.- I and calculate:
   i. The dimension of bearing,
   ii. The coefficient of friction,
   iii. The power lost in friction,
   iv. Total oil flow in litter/minutes,
   v. Temperature rise and average temperature,
   vi. Maximum oil film pressure
   vii. Eccentricity,
   viii. Angel of eccentricity or attitude angle.

TABLE NO.-1

Table: Dimensional performance parameters for full journal bearing with side flow.

$\left(\frac{l}{d}\right)$	ε	$\left(\frac{h_v}{c}\right)$	S	$\emptyset$	$\left(\frac{r}{c}\right)f$	$\left(\frac{Q}{rcn_s l}\right)$	$\left(\frac{Q_s}{Q}\right)$	$\left(\frac{p}{P_{max.}}\right)$
1	0	1.0	∞	(85)	∞	π	0	-
	0.1	0.9	1.33	79.5	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	74.02	12.8	3.59	0.280	0.529

	0.4	0.6	0.264	63.10	5.79	3.99	0.497	0.484
	0.6	0.4	0.121	50.58	3.22	4.33	0.680	0.415
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	26.45	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	15.47	0.514	4.82	0.973	0.152
	1.0	0	0	0	0	0	1.0	0

SECTION II

Q. 7   **A** Following data is given for a hydrostatic thrust bearing.   18

Thrust load	=450kN
Shaft speed	=750 r.p.m
Shaft diameter	=400mm
Recess diameter	=250mm
Viscosity of lubricant	=30cP
Specific Gravity of lubricant	=0.86
Specific heat of lubricant	=2 kJ/kg°C

Draw a neat sketch showing the effect of film thickness on energy losses.
Calculate:
   i.   The optimum oil film thickness for minimum power loss,
   ii.   The total power loss,
   iii.   The temperature rise, assuming the total power loss in bearing is converted into frictional heat

OR

Q. 8   **A** Derive relation for flow rate of lubricating and load carrying capacity   10
for a circular step Bearing with neat sketch.

   B Discuss different types of energy losses in hydrostatic bearing & derive   08
an equation for the same.

Q. 9   A rectangular plate is approaching an oily fixed plane surface with   16
velocity 'V' at the instant, the film thickness is h1, if both the surfaces
are separated by a lubricant of viscosity $'\mu'$. Derive the expression for
the time 't' taken to reduce the film thickness from h1 to h2.

OR

Q. 10   A   Explain the mechanism of squeeze film lubrication. Where does it occur?   08

        B   Explain merits , demerits & applications of gas bearing.   08

Q. 11   A   Write a short note on (any two)-   08
   i.   Plastic bearing materials
   ii.   Sintered metal bearings
   iii.   Bi and Tri metal bearing.

        B   Explain different types of gaskets and oil seals.   08

OR

Q. 12   A   Derive the expression for load carrying capacity of Rayleigh step which has entry zone gap of h_1 over a length of B_1 and exit zone gap of h_0 over a length of B_0 and sliding with a velocity of U.   10

$$\frac{h1}{h2} = 1.87 \quad and \quad \frac{B1}{B2} = 2.588$$

        B   Discuss the mechanism of elasto-hydrodynamic lubrication and give its applications.   06

UNIVERSITY OF PUNE
[4364]-60
B. E. (Mechanical Sandwich) Examination - 2013
Machine Tool Design (Elective-II)
(402065)(2003 Course)

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

Instructions:

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. *Black figures to the right indicate full marks.*
5. *Assume suitable data, if necessary.*
6. *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

SECTION –I

UNIT-I

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

OR

| Q.2 | A | Discuss the recent trends in Machine Tool Design with respect to | 10 |

     i) Operating speed range
     ii) Accuracy
     iii) Control systems

| | B | Explain PIV drive with block diagram. | 8 |

UNIT-II

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

OR

| Q. 4 | A | Design a three stage 12 speed gear box transmitting 7.5 KW power with Speeds from 80 rpm to 1000 rpm. The minimum number of teeth on gear 17. Electric motor speed is 1440 rpm. Draw structural diagram and also Calculate number of teeth on gears. | 16 |

UNIT-III

| Q. 5 | A | Describe various methods used for compensation of wear of guides. | 8 |

| | B | Describe stick-slip sliding. Explain its remedies. | 8 |

OR

| Q. 6 | A | What is static and dynamics stiffness? What is their effect on selection of Material for slideways? | 8 |
| | B | Discuss various types of lubrication systems for beds & slideways. | 8 |

SECTION II
UNIT-IV

| Q. 7 | A | Describe working of a ball recirculating power screws. Explain how preloading is carried out in ball screws. | 10 |
| | B | Discuss design consideration for spindle unit of machine tool. | 8 |

OR

| Q. 8 | A | What is the importance of power screws in machine tools? Discuss design factors to be considered while designing
i) Sliding friction power screws
ii) Rolling friction power screws | 10 |
| | B | Explain how the optimum spacing between spindle supports is determined while designing the machine tool spindles. | 8 |

UNIT-V

| Q. 9 | A | Explain hydraulic system used in shaper. | 8 |
| | B | Explain hydraulic system is used for chuck clamping in machine tools. | 8 |

OR

| Q. 10 | A | What is adaptive control system? How it is used in recent machine tools. | 8 |
| | B | Explain principle and working of Electric braking system in machine tools. | 8 |

UNIT-VI

| Q. 11 | A | State and discuss design features of NC and CNC machines. | 8 |
| | B | Explain part programming of CNC machines. | 8 |

OR

| Q. 12 | A | Discuss types of ATC (Automatic Tool Changer) | 8 |
| | B | Explain Closed loop system of CNC machine in details. | 8 |

UNIVERSITY OF PUNE
[4364]-61
B. E. (Mech. S/W) Examination - 2013
NON CONVENTINAL ENERGY SOURCES
(2003 Course)(402065)

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

Instructions:

1   *Answer three questions from Section 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   *Figures to the right indicate full marks.*

5   *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

SECTION -I

Q.1   A   Explain the trends of energy source utilization in power generation.   9
        B   Classify the non conventional energy sources and discuss their relative merits and demerits.   8

OR

Q.2   A   Write a note on low temperature power generation cycle using flat collector. Also write the experimental investigations in India.   9
        B   Explain the following terms in solar radiation geometry with suitable diagrams.   8
                I.   Latitude
                II.   Declination
                III. Surface Azimuth angle
                IV.   Hour angle

Q. 3   A   Write a note on effect of various parameters on liquid flat plate collector efficiency.   8
         B   Determine the local solar time and declination at a location latitude 23°15' N, Longitude 77°30' E at 12.30 IST on June 19.Equation of time correction is given from standard table or chart= - (1'01"), take standard time longitude = 82°30°.   9

OR

Q. 4   A   Explain the function of main components of a liquid flat plate collector with a neat sketch and materials used in it.   10

| | B | What is the effect of selective surfaces and number for covers on performance of flat plate collectors | 7 |

| Q. 5 | A | Write the limitations of flat plate collectors and advantages of concentrating solar collectors. State the different types of concentrator used. | 8 |
| | B | Explain the working of solar pond and effect of various parameters on its performance. | 8 |

OR

| Q. 6 | | Write short notes on | 16 |

a) Solar distillation system
b) Parabolic trough Concentrator
c) Pyrheliometer.
d) Heliostats

SECTION II

| Q. 7 | | Discuss the applications of wind energy. Explain merits and demerits of wind energy and its limitations. | 16 |

OR

| Q. 8 | | Explain the features of Geo-Thermal energy, its applications, advantages and disadvantages. | 16 |

| Q. 9 | | What kind of materials is used to manufacture photo voltaic cell? Explain the applications of most commonly used photovoltaic cells. | 16 |

OR

Q. 10	A	What is the basic principle of a tidal power plant	3
	B	Explain in brief working of a fuel cell.	4
	C	Explain any three types of fuel cells? What are the problems associated with these fuel cells?	9

| Q. 11 | | Write a short note on any three of the following: | 18 |

a) Environment protection norms ISO 14000.
b) Biomass gasification.
c) Biogas for diesel engines.
d) Dome type biogas plant.

[4364]-51

B. E. (Mechanical Sandwich) Examination - 2013
Industrial Hydraulics and Pneumatics
(2003 Pattern)

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) Neat diagrams must be drawn wherever necessary.

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

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

(5) Assume suitable data, if necessary.

(6) All questions are compulsory

SECTION-I

Q. 1. A) Discuss properties of petroleum based fluids used in hydraulic systems. (6)

B) What is hydrostatic and hydrodynamic power transmission? (6)

C) Explain in brief the areas of application fluid power. (6)

OR

Q. 2. A) What are the source of oil contamination? How to control it? (6)

B) What is the difference between static and dynamic seal? (6)

C) Explain with the help of graphs, the effect of temp and pressure on Hydraulic fluid (6)

Q. 3. A) What are the different a pplications of Accumulators in hydraulic systems? (4)

B) Explain working of gear pump with the help of a neat sketch (8)

C) What is difference between positive displacement pump and Non positive displacement pump. (4)

OR

Q. 4. A) Give classification of pumps. (4)

B) What do you mean by characteristic curves of a pump? And draw it. (6)

C) What is the function of a Hydraulic power unit? Explain with neat   (6)
   Diagram.

Q. 5.A) Draw a neat sketch of a typical 4 way Two position direction control
valve, explain its working in short.   (6)

   B) Draw a neat sketch and explain working of a pressure and   (10)
temperature Compensated flow control valve.

OR

Q. 6. A) Draw a explain counterbalance valve. Name one application of
counterbalance valve, explain its Purpose with a hydraulic circuit   (10)

   B) Explain characteristic of open centered and closed center and   (6)
       Tandem type of DC.

SECTION-II

Q. 7. A) What are the different application of hydraulic circuits in machine   (12)
       Tool. Explain shaping machine application with hydraulic circuit.

   B) What are the different cylinder mountings?   (4)

OR

Q. 8. A) Draw and explain circuit for hydraulic press with accumulator and   (8)
       Intensifier.

   B) Draw a hydraulic circuit using two sequence valve and a four way   (8)
       Control valve to operate two cylinders in sequence.

Q. 9. A) Compare pneumatic power with hydraulic power.   (6)

   B) What are the different methods of actuations of different control   (4)
       Valves used in pneumatic?

   C) What is FRL in pneumatic systems explain with symbols.   (6)

OR

Q. 10. A) Draw a neat sketch and explain working of   (12)
       i.   Shuttle valve
       ii.   Quick exhaust valve
       iii. Five nay two position DC valve

   B) Write in brief an application of pneumatics in law cost Automation.   (4)

Q. 11.   Explain with proper application
   A) i) Meter in circuit   (12)

ii) Meter out circuit

B) Draw and explain any typical pneumatic circuit for a control of   (4)
Double acting cylinder.

<div align="center">OR</div>

Q. 12.   Draw pneumatic circuit   (16)

    i.   AND gate for a proper application
   ii.   OR gate for a proper application

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[Total No. of Pages :]

4364-52
B.E. (Mechanical-S/W)
Refrigeration and Air Conditioning
(2003Pattern) (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) *Solve any three questions from each section*
5) *Use of Calculator is allowed.*
6) *Assume Suitable data if necessary.*

SECTION I

Q1) a) Write a note on 'magnetic refrigeration'.   **[5]**
     b) What is necessity of air-craft refrigeration.   **[3]**
     c) Explain boot strap system with the help of T-S diagram. Derive the expression for **[8]**
         COP.

OR

Q2) a) Write a note on 'thermoelectric refrigeration'.   **[5]**
     b) Explain the concept of DART.   **[3]**
     c) Explain reduced ambient system with the help of T-S diagram. Derive the **[8]**
         expression for COP.

Q3) a) Write a note on Desirable properties of refrigerants.   **[6]**
     b) Explain the following terms: **[12]**
             i)   Ozone Depletion Potential
             ii)   Global Warming Potential
             iii) TEWI

OR

Q4) a) Write a note on refrigerant recovery, recycling and reclaiming. **[6]**
     b) Discuss the classification of refrigerants used in refrigeration plants **[6]**
     c) Write a note on 'Refrigeration Piping and Design'.   **[6]**

Q5) a) Explain Two stage compression with flash gas removal.   **[6]**
     b) What is a selection criterion of refrigerant absorbent mixture? **[4]**
     c) Explain cascade system with the help of P-h diagram.   **[6]**

OR

Q6) a) Explain Electrolux system with a neat sketch.   **[6]**
     b)   **[8]**
     c) In an absorption refrigeration system heating , cooling and refrigeration takes **[4]**
         place at temperature of 100 ºC, 20 ºC and – 10 ºC respectively. Find the
         theoretical COP of the system.

SECTION II

Q7) a) What is infiltration load and ventilation loads. Discuss in details with methods to calculate infiltration load. **[8]**

b) Compare unitary and Central air conditioning system. Explain all water system with neat diagram. **[8]**

OR

Q8) a) Write Short note on any two:
   i) All air system **[10]**
   ii) Air-water Combination system
   iii) Automobile air conditioning system

b) Explain with hand drawn psychrometric chart the concept of RSHF, GSHF, ERSHF. **[6]**

Q9) a) Enumerate the basic elements of the control system, Explain. **[8]**

b) Write short note on: **[10]**
   i) Bimetal type thermostat fro room temperature
   ii) Hair type humidistat for humidity control in air conditioning.

OR

Q10) a) What is a 'duct' in air conditioning? Classify the ducts used in air conditioning. **[6]**

b) What are the desirable properties of an ideal duct material? Name some commonly used duct materials. **[6]**

c) What are the different methods used for determination of duct size? Explain any one method. **[6]**

Q11) a) What is Cryogenics? List out the difficulties encountered in the production of low temperatures with the help of single or multistage vapour compression refrigeration system **[8]**

b) Explain the different methods of liquefaction of air. What are the advantages of Claude system over Linde system? **[8]**

OR

Q12) a) Write a note on Cold Storage **[6]**

b) Explain the factors which are responsible for the spoilage of food and vegetables? What are the methods for preservation of food and vegetables? **[12]**

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[Total No. of Pages :]

[4364]-53
B.E. (MECH S/W)
ROBOTICS
(2003Pattern) (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) *Solve any three questions from each section*
5) *Use of Calculator is allowed.*
6) *Assume Suitable data if necessary.*

SECTION I

Q1) a)   Sketch and explain the following configurations of robots -TRR, TRL:R, [8]
          RR:R.

     b)   Enlist the specifications of an industrial robot and explain each of them briefly. [8]

Q2) a)   Sketch and explain various types of joints in manipulator mechanism [6]
     b)   Sketch and explain all D-H parameters between two coordinate frames [6]
     c)   Write a note on playback robots. [6]

Q3) a)   Explain the following terms, applied to robot arms and their importance [10]
          i)Inertia terms, ii) Coupling inertia, iii) Centrifugal force, iv) Coriolis'
          component, v) Gravity terms, with respect to dynamics of the manipulator.

     b)   Discuss various difficulties associated with the inverse kinematic solution and [6]
          explain the 'geometric approach' technique used in inverse kinematic problem

Q4) a)   What is dexterity? Does it get improved by redundant degree of freedom? [6]
          Explain.

     b)   b) Write the homogeneous matrix for the following motions - [4]
          i) Translation,
          ii) Rotation about X axis,
          iii) Rotation about Y axis,
          iv) Rotation about Z axis.

     c)   What is a composite transformation matrix? Explain the rules to be followed in [6]
          the formation of the same.

Q5) a)   Describe any four types of controllers used in robotic systems, mentioning their [6]
          respective transfer functions.

     b)   Define and explain - i) Delay time, ii) Settling time, iii) Peak overshoot. [6]

SECTION II

Q6) a)   Sketch and explain difference between external gripper and internal [6]
          gripper.

     b)   Sketch and explain difference between angular gripper and parallel gripper. [6]

     c)   How are robot end effectors classified? Draw and explain any four types of [6]
          end effectors.

Q7)	a)	An incremental shaft encoder with 2 emitter-detector pairs and 12 slots around the circumference is used to monitor the angular position of a high speed motor shaft. The angular precision of the output shaft is found to be 0.05° per count. What is the gear ratio between the motor and the output shaft?	[8]
	b)	Explain a machine vision/robot vision system with a sketch. Give practical examples of its' applications.	[8]

Q8)	a)	Explain construction and working of anyone proximity sensor.	[6]
	b)	Sketch and describe force sensing wrist.	[6]
	c)	Explain the desirable features of the sensor vision system	[6]`

Q9)	a)	Explain palletizing and de-palletizing application of robotic system.[	[8]
	b)	Explain advantages of robotic operation for spray coating over manual Operation.	[8]

Q10)	a)	Explain in brief, the various programming methods used in robotics with examples and features of each.	[8]
	b)	What are different electrical actuators? Explain the working principle of stepper motor with sketch. Explain micro-stepping used in stepper motors.	[8]

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   [6]

its magnitude.

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 [8] 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.

UNIT-2

Q3 a) The firing order in a 6 cylinder vertical four stroke in-line engine is [12] 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.

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

2

Q4 a) A,B,C and D are four masses carried by a rotating shaft at radii 100,125,   [12]
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
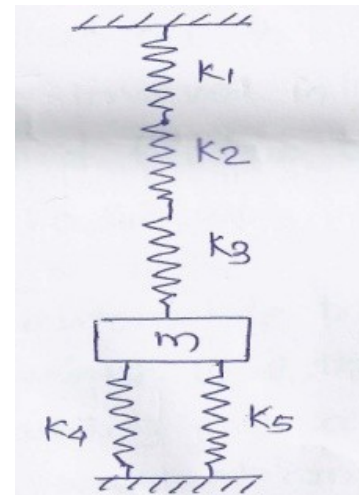complete balance.

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   [8]
'l' of certain liquid. Find the natural period of oscillation of the liquid column

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

3

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 [8] 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?

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

OR

Q8 a) The springs of an automobile trailer are compressed 0.1 m under its own [8] 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.

b) A 1000 kg machine is mounted on four identical springs of total spring [10] 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

UNIT-5

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

b) A system is shown in fig.2. find the equation of motions of masses for the [8] 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.
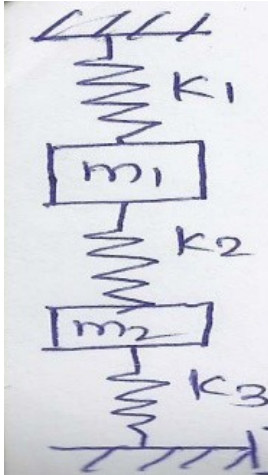
OR

Q10 a) A shaft of 100 mm diameter and 1 metre long has one of its end fixed   [8]
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.

   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   [8]
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?

OR

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

 b) Determine the mass M to be placed at the end of reeds of Frahm   [8]
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.

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]

Instructions
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   (10)
reactions and elemental stresses. Cross sectional area of each
element is 1000mm^2.
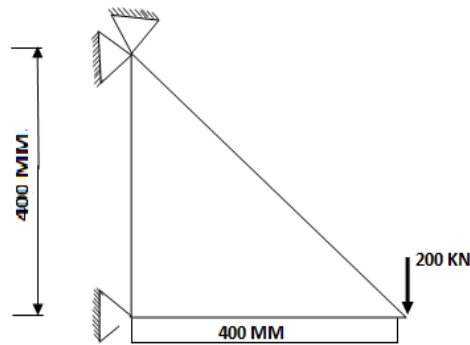
Take E = 200GPa

Fig . 1

OR

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

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

SECTION II

Q.7   A.   A constant strain triangle element is defined by three nodes at (2.6,   (8)
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.

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

OR

Q.8   A.   Discuss the problem Modeling and Boundary Conditions for the   (8)
following cases:

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   (4)
combining CNC & DNC?

2

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)
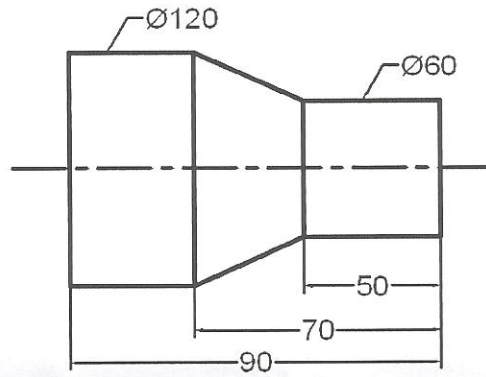

Fig. 2.

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)
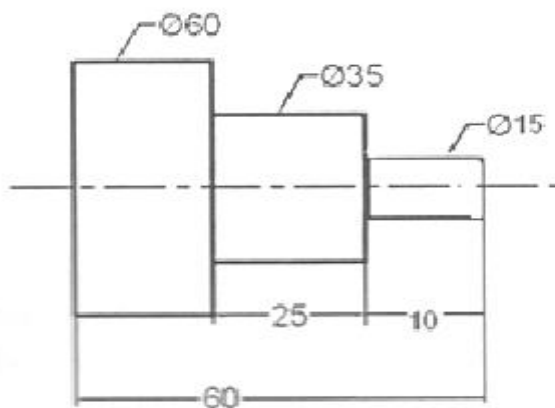

Fig. 3.

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)

UNIVERSITY OF PUNE
[4364]-50
B. E. (Semester - I) Examination –2013
B.E. Mech S/W (2003 Course)
Design Engineering

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

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

Instructions :

1) Answer **three** questions from section-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) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

5) Assume suitable data, if necessary.

SECTION – I

Q.1 a) Derive the equation for beam strength of a bevel gear. Draw a sketch [8]

b) A pair of worm and worm wheel is designated as 3/60/10/6. The worm [8] is transmitting 5 kw power at 1440 rpm to worm wheel. Determine the components of gear tooth force acting on the worm and worm wheel. Draw the free body diagram.

OR

Q.2 a) Drive the equation for the face width of worm gear. Draw a sketch.   [8]

b) A 21 teeth straight bevel pinion rotating at 720 rpm transmits 10 kw   [8]
power to a 40 teeth bevel gear. Module is 6mm and pressure angle is 20^0
face width is 45 mm. If the shaft angle is 90^0, find the components of forces
acting on the gear pair

Q.3 a) Explain the procedure for design of vertical pressure vessel according to   [10]
is 2825.

b) Describe various methods of prestressing of thick cylinders.   [8]

OR

Q.4 a) cylindrical pressure level of inside diameter 1500 mm is subjected to   [18]
internal pressure of 2 Mpa. The shell as well no heads are made of steel
with ultimate tensile strength of 450 Mpa. Double welded butt joints which
are spot radiographed are used to fabricate the vessel.

b) Corrosion allowance is 3 mm. Find the thickness of cylindrical shell and
thickness of head if the heads are

i)   flat
ii) Plain formed
iii) Torispherical with Crown radius of 1125mm
iv) Semi elliptical with ratio of major to minor axis as 2

Q.5 a) With examples , suggest methods to improve design while [6]
   manufacturing components by powder metallurgy.

   b) A shaft and bore is given a fit of 4046 is Assuming dimensions to be [10]
   normally distributed find the probability of Interference fit between
   the components.

	H 6_{mm}	j 5_{mm}
Ø40 $_{mm}$	+0.016	+0.006
	+0.000	-0.005

   Area of curve form 0 to z is given below.

z	2.1	2.2	2.3	2.4	2.5	2.6	2.7
A.	0.4821	0.4861	0.4893	0.4918	0.4938	0.4953	0.4965

OR

Q.6 a) Explain principles used in design of forging with respect to draft angle; [6]
   lateral shifting and inclined parting line.

   b) A machine member has a yield strength of 250 MPa and a standard [10]
   deviation of 30 MPa. This member is subjected to a bending stress
   with a mean of 160MPa and standard deviation of 15MPa. Find

i) Probability of failure and reliability of member

ii) Minimum factor of safety.

iii) Average factor of safety.

Assume normal distribution.

SECTION II

Q.7 a) Derive the equation for fatigue stren for a component subjected to [8] to finite life

b) A plate made of steel (Sult =580 MPa) is subjected to a completely [10] reversed axial force of 40 KN. The theoretical stress concentration factor at the change of cross-section is 2.27 and the notch Sensitivity is 0.8 The surface finish factor and size factor values are 0.75 and 0.85 respectively. The load factor is 0.923. The expected reliability factor is 0.897. If the required factor of safety is 2, find the plate thickness for infinite life.
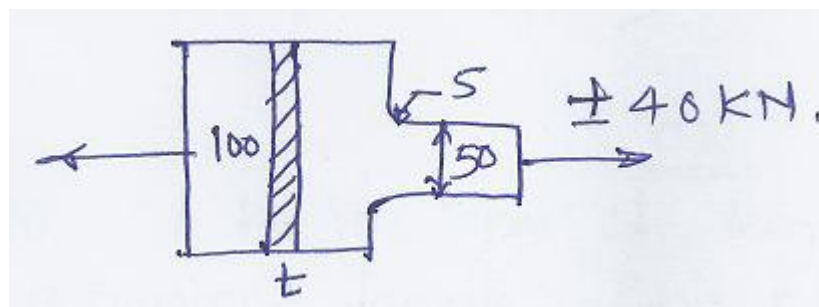
OR

Q.8 a) State and explain Miner's Rule for design of component [6] subjected to fluctuating stress.

b) A mechanical component is subjected to following stress cycle   [12]

   i) $\pm$ 350 MPa for 70 % time

   ii) $\pm$ 500 MPa for 5% time

   iii) $\pm$ 300 MPa for remaining time.

The component is made of Steel (Sult = 660 MPa). If the endurance

limit is 280 MPa find the life of component.

Q.9 a) Explain the Johnson's method of optimum design.   [6]

   b) Initial preload for a helical compression spring is 675 N. The   [10]

maximum load is limited by permissible torsional shear stress which

is 750 MPa. Due to space limitations the outer diameter of spring

should not exceed 50 mm. specify the spring dimensions for

minimum   weight.

OR

Q.10 a) A tensile bar of length 200 mm is subjected to a constant tensile   [16]

force of 5000 N. If the factor of safety is 3, design the Bar with the

objective of minimizing the material cost out of the following materials.

Material	Density kg/m^3	Cost Per unit mass	Yield strength

		Rs/kg	MPa.
Steel	7800	14	400
Al. alloy	2800	66	150
Ti alloy	4500	1100	800
Mn alloy	1800	75	100

The cls area should not be less than 50 mm^2

Q.11 a) Explain different types of belt conveyor layouts [8]

b) Explain basic types of product forms with diagrams [8]

OR

Q.12. a) What is Qualitative display? What are the design recommendations [8]

for the qualitative display?

b) Explain conveyor belt sag in belt conveyors. State equation for [8]

carrying & return idler Sag.

4364_55

B.E. (Mechanical S/W)

Automobile Engineering

(2003Pattern) (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) *Solve any three questions from each section*
5) *Use of Calculator is allowed.*
6) *Assume Suitable data if necessary.*

SECTION I

Q1) a) How do you classify automobiles? Explain them with the help of examples. Give specifications of any one petrol car of your choice. [8]

b) Describe the construction and working of a single plate clutch. What are the troubles in the clutch system and how those are rectified? [8]

Q2) a) Explain the followings [8]

1 Closed car   2 Open car
3 Articulated vehicle   4 All wheel drive

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

Q3) a) Explain with a neat sketch vacuum operated clutch. Explain its advantages and disadvatages . [8]

b) Explain the following [8]

1 Tractive effort   2 Performance curves

Q4) a) Explain the principle of gearing. Explain various resistances to the motion of a vehicle [8]

b) Explain overdrive along with neat sketch. State its advantages [8]

Q5) a) Explain the working and construction of the following [9]

1 Shock absorber   2 Rubber suspension springs

b) What are the common troubles experienced in the suspension system of an automobile and suggest appropriate remedies. [9]

SECTION II

Q6) a) Describe various types of stub axles with the help of suitable diagram and state merits and demerits of each of them. [9]

b) Write a short note on Wheel Alignment and Wheel balancing. [9]

Q7) a) Name the different types of steering gear boxes. Explain any one type with a neat sketch. [8]

b) Explain different types of propeller shaft with neat sketches. [8]

Q8) a) Explain construction and working of tubeless tyre and explain its merits/demerits over other tyres [8]

b) Explain in brief working principle of the Differential. Draw a sketch of Bevel gear differential and describe its working. [8]

Q9) a) Compare torque tube drive and Hotchkiss drive in detail with sketches [8]

b) Explain the following [8]

1 Universal joint

2 Various forces and torques experienced by rear axle.

Q 10) a) Explain the working of Anti-skid braking system with neat sketch. [8]

b) What are the different types of ignition system in automobile . Explain any one of them in brief. [8]

B. E.(Mechanical Sandwich)Examination - 2013
COMPUTATIONAL FLUID DYNAMICS(ELECTIVE I)
(2003 Pattern) (402063)
[Total No. of Questions:12]   [Total No. of Printed Pages :2]
[Time : 3 Hours]   [Max. Marks : 100]

Instructions :

*(1) Answer **Q1 or Q2, Q3 or Q4, Q5 or Q6** from section I and* ***Q7 or Q8, Q9 or Q10, Q11 or Q12*** *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, Mollier charts, electronics pocket calculator is allowed.
(6) Assume suitable data, if necessary.

SECTION-I

Q1   a) For a 2D infinitesimally small control volume of size dx, dy, with   [12]
neat diagram show all body and surface forces and derive the momentum
equation in differential conservative form.
b) What is divergence of velocity? Explain its physical meaning.   [6]
                                        OR
Q2   a) Explain the different flow models used in CFD. What are   [10]
conservation and non-conservation form of governing equations?
b) Explain the substantial derivative. What is its physical significance?   [8]
Q3   a) Solve $\frac{dy}{dx} = \sqrt{x + y}$ subject to y(0) =1. Find y(0.2) using h=0.1   [6]
b) Explain the Shooting method for solution of Blasius equation.   [10]
                                        OR
Q4   a) Solve the system of equations using Runge Kutta method   [8]
$\frac{dy}{dx} = x + yz, \frac{dz}{dx} = x^2 - y^2$ subject to y(0) = 1 & z(0)=1/2.
Find y(0.2) and z(0.2) using h=0.2
b) Explain the adaptive step size in Runge-Kutta method.   [8]

Q5   a) What is artificial viscocity? Discuss some aspects of artificial   [6]
      Viscocity.
      b) Discuss in detail explicit and implicit approaches for obtaining   [10]
      solution in CFD.

<div align="center">OR</div>

Q6   a) Explain: convergence and stability of numerical solution.   [6]

b) Find the forward difference approximation of O(Δx) for $\left(\dfrac{\partial^4 u}{\partial x^4}\right)$ [10]

Using   i) Taylor's series expansion
                   ii) Forward difference formula

<div align="center">SECTION-II</div>

Q7   a) The 1 dimensional heat conduction equation for the fin is given by   [18]
      $\dfrac{dT^2}{dx^2} - \dfrac{hp}{kA}(T - T\infty) = 0$ where P & A are the perimeter and the
      cross sectional area of the fin respectively. Give the solution procedure
      to find temperature at various points over the length of fin.

<div align="center">OR</div>

Q8   a) Write solution algorithm for thermally developing flow inside a 2   [18]
      Dimensional channel or circular pipe

Q9   a) Compute the solution of the equation $\dfrac{\partial u}{\partial t} = -c\,\dfrac{du}{dx}$ where C =   [12]
      Constant > 0. Compute for first two time step only using Mac-Cormack
      Technique.
      b) Write comment on Lax-Wend roff and Mac-Cormack techniques.   [4]

<div align="center">OR</div>

Q10   a) Explain MacCormack technique of obtaining solution of flow   [10]
      equations in detail.
      b) What is stability in numerical computations? Give its requirement in   [6]
      brief.

Q11   a) Give details of MAC algorithm for solution of navier stokes equations[16]
      for incompressible flows.

<div align="center">OR</div>

Q12   Write short notes on **any two** of the following   [16]
         1. SIMPLE Algorithm
         2. Finite volume method
         3. Stability consideration

UNIVERSITY OF PUNE
[4364]-59
B. E. (Mech. S/w) Examination - 2013
PRODUCTION MANAGEMENT elective 402065(C) (2003 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 What is industrial Engineering? What is contribution of FW Tailor and Frank Gilbirth to production management?   8

B Which different charts are used in method study? Explain one chart in details.   8

OR

Q.2 A What is Ergonomics? What is its importance? Explain with example   8

B Explain :- i) Time study   ii) MOST   8

Q. 3 A What is TQM? What are its objectives? Explain PDCA cycle.   8

B Explain i) Group dynamics   ii) Costs associated with quality.   8

OR

Q. 4 A What is appraisal and failure costs? Explain it.   8

B What are quality circles? How they are benefited to employer & employees?   8

Q. 5 A Write short on any three:-   18

     i) Anthropometry principles & applications

     ii) Recording techniques in method study

     iii) Dr. Demings contribution to quality & productivity

     iv) QC tools

     v) Ergonomics and safety

SECTION II

Q. 6 A What is quality function deployment? Explain in brief.   8

B What is TPM? Discuss its important pillars.   8

OR

Q. 7 A What is ISO 9000? Mention five standards of ISO9000 series.   8

B What is $\bar{X}$ and R chart? Explain with steps $\bar{x}$ chart. Where they are used?   8

| Q. 8 | A | What is management of change? What are types of change management has to undergo? | 8 |
| | B | What is BPR? Explain in brief principles involved in it. | 8 |

<div align="center">OR</div>

| Q. 9 | A | What is motivation? How Henzbery two factor theory in important to production manager? | 8 |
| | B | Compare continuous and break through improvement. | 8 |

| Q. 10 | | Write short notes on (ant three):- | 18 |

    i)   Concurrent engineering and its need
    ii)   Lean manufacturing
    iii)   Design for manufacturing and design for assembly
    iv)   House of quality
    v)   Value engineering and value analysis.

4364-57

B.E. (Mechanical S/W)
Industrial Engineering(4020610)
(2003Pattern) (Elective - III) (Semester - II)

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) *Solve any three questions from each section*
5) *Use of Calculator is allowed.*
6) *Assume Suitable data if necessary.*

SECTION I

Q1) a) Explain basic techniques involved in Industrial Engineering.   [8]
     b) What are the contributions of F.W.Taylor & Frank Gilbreth in Industrial
         Engineering?   [8]

OR

Q2) a) What are Therbligs? When they are used? Give any three Therbligs with
         symbols.   [8]
     b) Explain construction and applications of Multiple Activity Chart & Two Handed
         Process Chart.   [8]

Q3) a) Explain the steps in Work Sampling Study   [8]
     b) What is MOST? Explain Mini MOST, Maxi MOST and Basic MOST   [8]

OR

Q4) a) Explain detail procedure for conducting Method Study.   [8]
     b) Explain detail procedure for calculating standard time in time study.   [8]

Q5)   Write Short Notes on: (Any Three)   [18]
     a) Man-Machine System.
     b) Anthropometry and its importance.
     a) Design of workplace.
     c) Percentile.

Q6) a) Classify & Describe in brief Operation Research Models.   [8]
     b) What are the aim and objective of Operation Research?   [8]

OR

Q7) a) State advantages, limitations & applications of Linear Programming.   [8]
     b) Explain the terms Duality and Sensitivity.   [8]

Q8) a) Define material Handling; explain its principles in details.   [8]
     b) Explain principles, objectives and functions of Storage & Warehousing   [8]

OR

Q9) a) Explain the need of Facility Planning by considering its elements like water, electricity, market, capital etc.   [8]
     b) Discuss the important steps in layout planning. Explain in brief what computerized layout is planning.   [8]

Q10)   Write Short Notes on: (Any Three)   [18]
     a)   MRP (Manufacturing Resource Planning)
     b)   JIT system.
     a)   Aggregate control of Inventory system.
     c)   MPS (Master Production Schedule)

◊◊◊◊