

**Sardar Patel College of Engineering**

Munshi Nagar, Andheri (W), Mumbai

(An autonomous institute affiliated to university of Mumbai)

Class/Sem:- BE MECH, VII

Subject: BPR & TQM

Marks: 100

Time: 3 Hour

Instructions: 1. Attempt any Five questions out of Seven questions  
2. Figures to the right indicate full marks.

- Q1) a) Explain the role of Information Technology in BPR projects (10)  
b) State the need of ISO 9000 and explain Quality Auditing with example. (10)
- Q2) a) Define BPR as per "Hammer and Champy". What are the objectives of BPR. (10)  
b) Justify the statement "Successful implementation of BPR is not necessarily expensive"  
c) Explain Davenport's BPR implementation methodology. (10)
- Q3) a) Explain the guiding principles (7R's) (10)  
b) What are the challenges faced by Re-engineering projects? How can we overcome them? (10)
- Q4) a) Compare BPR with TQM. Comparison should give both similarities and dissimilarities. (10)  
b) Explain how CSF (Critical Failure Factors) affects BPR. (10)
- Q5) a) Explain House of Quality? List and explain the different steps involved in House of Quality. (10)  
b) Explain Quality Function Deployment with suitable example? State advantages of QFD (10)
- Q6) Explain following terms with suitable example (20)  
a) KAIZEN  
b) 5S  
c) Taguchi method  
d) PDCA Cycle
- Q7) a) Discuss the main elements of ISO 14000 (5)  
b) Explain Six Sigma and process capability (5)  
c) What is Total productive maintenance? List the objectives of TPM (5)  
d) What are the seven tools of quality (5)

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Bhartiya Vidya Bhavan's

**Sardar Patel College of Engineering**  
An Autonomous Institution Affiliated to Mumbai University

**End Semester**

**Academic year: 2014-15**

*master*

**Class: B.E. Mechanical - VII B.E (Mech). Sem VII** **Total Marks: 100**

**Subject: Elective -1 (Computational Fluid Dynamics)** **Duration: 3 hrs**

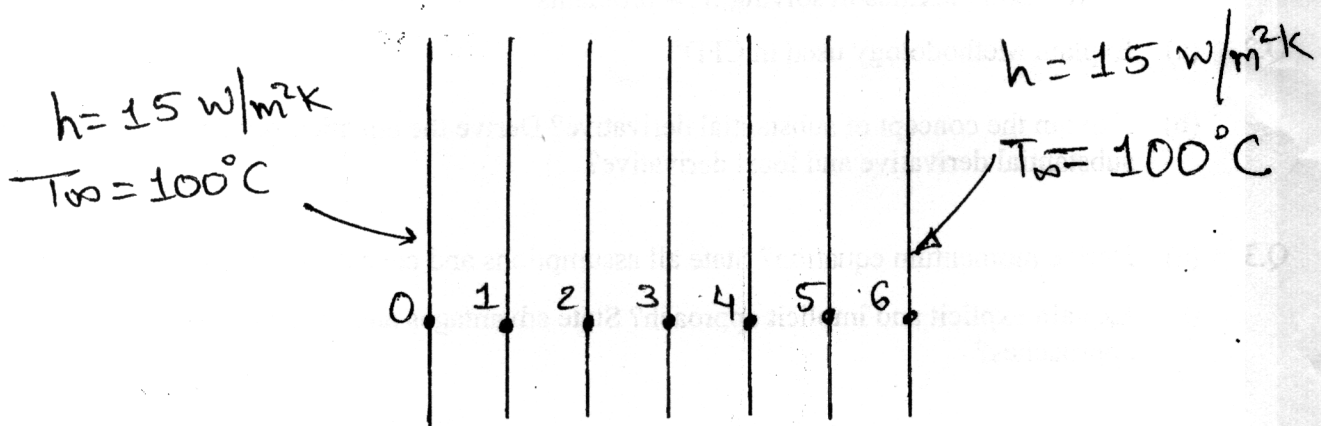
- Question no.1 is compulsory.
- Solve any four questions out of remaining six questions
- Figures to right indicate full marks
- Assume suitable data if necessary

- Q.1 Write Short notes on any four: 20
- (a) Experimental Approach
  - (b) Boundary Conditions in CFD
  - (c) Relaxation Methods
  - (d) Simple Algorithm
  - (e) Complexities in solving flow problems
- Q.2 (a) Explain Methodology used in CFD? 10
- (b) Explain the concept of substantial derivative? Derive the equation relating substantial derivative and local derivative? 10
- Q.3 (a) Derive momentum equation? State all assumptions and considerations made? 10
- (b) Explain explicit and implicit approach? State advantages and disadvantages of both approaches? 10
- Q.4 (a) Solve the following equations with Thomas Algorithm and compare it with Gauss elimination method? 10
- $3.5x_1 - x_2 = 2$   
 $-x_1 + 3.5x_2 - x_3 = 0$   
 $-x_2 + 3.5x_3 - x_4 = 0$   
 $-2x_3 + 3.5x_4 = 0$
- (b) Explain why stability criteria are required? How unstable equations are handled? 10



- Q.5 (a) The initial temperature distribution inside a homogenous flat plate of 60 cm is shown in figure 1. The plate is cooled from both sides by coolant at  $100^{\circ}\text{C}$ . The heat transfer co-efficient is constant and has a value of  $15 \text{ W/m}^2\text{K}$ . Find the temperature at grid locations. The properties of solids is  $K = 3 \text{ W/mK}$ ,  $\rho = 1500 \text{ kg/m}^3$ ,  $C = 0.9 \text{ kJ/kg K}$ . After 100 minutes? 10
- (b) Derive equation for Unsteady One Dimension Heat conduction in a plate? Derive its Stability Criteria? 10
- Q.6 (a) Derive equation for one dimension convection-diffusion problem? State its stability criteria? 10
- (b) Write different flow equations? What is FOU scheme? 10
- Q.7 (a) Give the Stream function Vorticity algorithm used for determination of velocity in viscous flows? 10
- (b) List different turbulence models? Explain any one model 10

Fig. 1



$t = 0$  to 100 mins

At $t = 0$ ,						
$T_0$	$T_1$	$T_2$	$T_3$	$T_4$	$T_5$	$T_6$
$600^{\circ}\text{C}$	$640^{\circ}\text{C}$	$960^{\circ}\text{C}$	$990^{\circ}\text{C}$	$960^{\circ}\text{C}$	$640^{\circ}\text{C}$	$600^{\circ}\text{C}$

**SARDAR PATEL COLLEGE OF ENGINEERING**

(An Autonomous Institution Affiliated to University of Mumbai)

Examination\_oct-nov 2014

Total Marks: 100

Duration: 4 Hours

CLASS/SEM: B.E.(Mech) \ VII

SUBJECT: FINITE ELEMENT ANALYSIS

- Attempt any FIVE questions out of seven questions.
- Figures to the right indicate full marks.
- Make any suitable assumption if needed with proper reasoning.
- Answer to the sub questions should be grouped together.

master

B.E (Mech), Sem-VII

- Q1 a) Determine the shape functions for quadratic bar element, also derive the stiffness matrix and load vector for the same. (take ' $q$ ' as force per unit length). 15
- b) Evaluate 2x3 Gauss quadrature for the integral. (eq.1) 05
- Q2 a) A rod under distributed and concentrated forces. Solve for nodal displacement, stress – strain and support reaction. Given:  $A=25 \text{ mm}^2$ ,  $E=200 \text{ GPa}$ ., total length= 2m, four elements of each 0.5m length. (Fig. 1) 20
- Q3 a) Determine the global stiffness matrix for element 1 and 2 of a 3-bar truss network. (fig.2) 10
- b) Determine the shape functions for nine-noded quadrilateral element with natural co-ordinates (use Lagrangian interpolation method). 10
- Q4 a) A bar with c/s area ' $A$ ' and length ' $L$ ' is subjected to uniform loading- $q_0$ . Find the displacement solution using i) weighted residual method and ii) Rayleigh-Ritz method. 12
- b) For a simply supported beam with uniformly distributed load develop the weak form and find the deflection solution. ( $EI \frac{d^4 v}{dx^4} - q = 0$ ) 08
- Q5 a) For three noded triangular element determine the displacements  $u, v$  at point 'P'. (fig.3) 08
- b) For three noded triangular element determine the temperature 'T' at point 'P'. (fig.4) 06
- c) Discuss Gauss quadrature formulae to evaluate the integral, also discuss how gauss sampling points are determined. 06
- Q6 a) Discuss the Cholesky factorization scheme for solution of stiffness matrix. 10
- b) Determine the shape functions for 2-D beam element. 10
- Q7 a) What is the compatibility of displacement in 2-D element? Explain. 06
- b) Explain the use of natural coordinates in FEM. 06
- c) What is Jacobian? Compute the Jacobian at each Gauss point (2x2). Fig.5 08

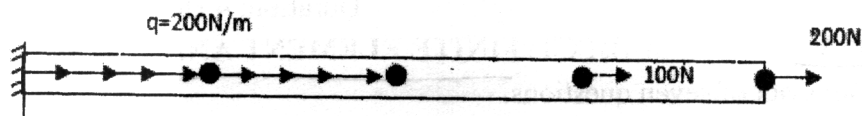


Fig.1

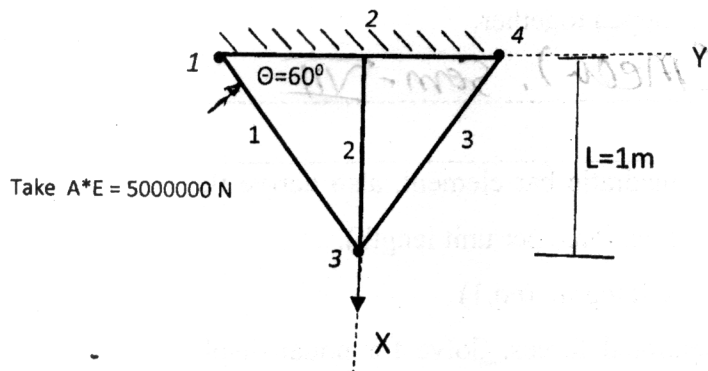


Fig-2

Fig-3

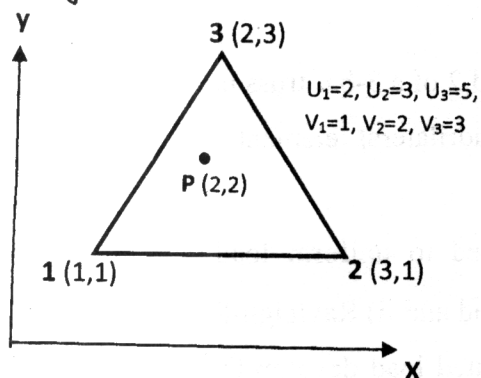


Fig-4

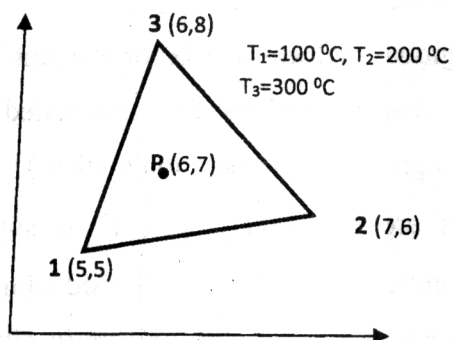
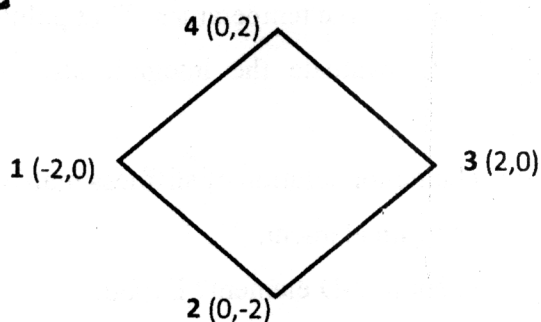


Fig-5



eg<sup>n</sup> 1

$$\int_{-1}^1 \int_{-1}^1 \frac{3+x^2}{2+y^2} dx dy$$

Bharatiya Vidya Bhavan's

**SARDAR PATEL COLLEGE OF ENGINEERING**

(An Autonomous Institution Affiliated to University of Mumbai)

Re examination Dec 2014

Total Marks: 100

Duration: 4 Hours

CLASS/SEM: B.E.(Mech) VIISUBJECT: FINITE ELEMENT ANALYSIS (ME412) 403

- Attempt any **FIVE** questions out of seven questions.
- Figures to the right indicate full marks.
- Make any suitable assumption if needed with proper reasoning.
- Answer to each sub-questions should be grouped together.

MASTER FILE.

Q1 Derive the shape function and stiffness matrix for a quadratic bar element having length  $L$ , area  $A$ . It has nodes at each end and an in-between node at  $0.25L$  from the 1<sup>st</sup> node. 8+12

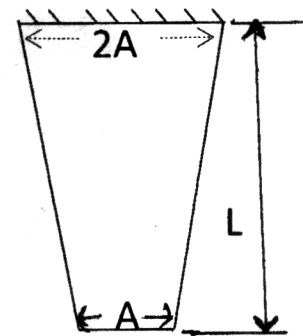
Q2 Derive the stiffness matrix for taper circular bar vertically hanging subjected to gravity loading (refer adjacent fig.). Use four element solutions, find the nodal displacements, and also find stress and strain in each elements as well. 4+8+4+4

$$A = 250 \text{ mm}^2$$

$$\rho = 80 \text{ kN / m}^3$$

$$E = 200 \text{ GPa}$$

$$L = 160 \text{ cm}$$



Q3 a) Solve the differential equation using two parameter trial solution. Use Galerkin method and compare with exact solution. B.C.  $y(0) = 1$ ; 8+3+4

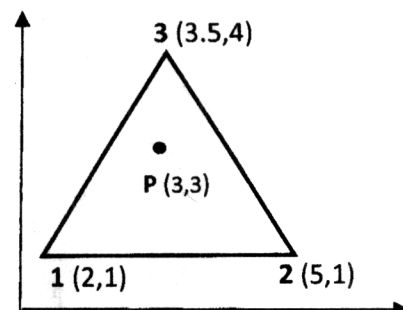
b) Explain different types of Boundary Conditions with suitable example. 05

Q4 a) Evaluate the Gauss quadrature for following: (refer table). Solve using  $1 \times 1$ ,  $2 \times 2$  and  $2 \times 3$  rule 2+4+6

$$I = \int_{-1}^1 \int_{-1}^1 \frac{3+\zeta^2}{2+\eta^2} d\zeta d\eta$$

b) For triangular element (CST) shown in adjacent fig., the nodal values of displacement are:

Obtain the displacement at P.  $U_1=2, U_2=3, U_3=5,$   
 $V_1=1, V_2=2, V_3=3$



Q5 Derive the  $[N]$  and  $[K]$  matrix for the beam element if the displacement field is given by  $V(x) = c_0 + c_1x + c_2x^2 + c_3x^3$ , also find load vector for gravity loading  $\rho Ag$  per unit length. 8+6+6



Finite Element Analysis -

- Q6 a) Discuss the Cholesky factorization scheme for solution of stiffness matrix. 10  
 b) What is Weak-form of weighted residual method? Explain with suitable example. What are the advantages of this method? 8+2
- Q7 a) Determine the shape functions for nine-noded quadrilateral element with natural coordinates (use Lagrangian interpolation method). 10  
 b) Discuss the characteristics of the stiffness matrix. 5  
 c) Explain the use of natural coordinates in FEM. 5

=====XXXXXOOOOOOXXXXX=====

**Table: Sampling points and weights for gauss quadrature**

<i>n</i>	<i>Location of sampling points</i>	<i>Weight factor</i>
1	0	2
2	+0.57735	1
	-0.57735	1
3	+0.77459	5/9
	0	8/9
	-0.77459	5/9

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**Bharatiya Vidya Bhavan's**  
**SARDAR PATEL COLLEGE OF ENGINEERING**

(An Autonomous Institution Affiliated to University of Mumbai)

**Nov. 2014**

**Total Marks: 100**

**Duration : 3 Hours**

**Class/Sem.: B.E. Mechanical Engineering Sem.-VII (mech).**

**Subject: IE-PM (Industrial Engineering & Project Management).**

- Attempt any Five questions out of Seven questions
- Figures to the right indicate full marks.
- Assume any suitable data if necessary.

master

B.E (Mech), sem- VII

Q.1A. You are the Chief Procurement Manager in Washing Machine Manufacturing company. The company has decided to design, develop and launch a new Washing machine with Optimum Water Consumption. The new washing machine needs new configuration. Explain Project Procurement Manager's Responsibilities and skills needed in such project in detail. Explain the tools used by you to carry out the work successfully. What are the Inputs and expected outputs. [10]

Q1B. Kale pumps is a established brand in South-Asia for the pumps. You joined this company as Chief Design Manager. The company decided to launch a new fuel dispensing pump which can operate in extreme environments [hot as well as cold]. Vice president of the company asked you to take this responsibility and now you are the Chief Project Manager of this project. Identify the risk involved, Evaluate the risk, rank them, develop the strategy to mitigate them and Justify your decision. [10]

Q2A. Alfred Engineering Corporation manufactures the Pressure vessels. You have joined this organization recently as a Chief Quality Manager. The company received a Project titled "Design and Development of Pressure vessel-PV10" The company records shows that there are multiple rejections, more rework in fabrication process. As a result the company missed the deadlines and there are huge rework cost. Explain in detail how will you perform? How will you collect data? How will you analyze the data? What tools will you use and how will you use them? What will be your strategy? What do you mean by COPQ- cost of poor quality in this context. [10]

Q2B. Sagar Oil and Natural Gas is one of the Key Players in Global Energy market. It delivers Innovative Equipments and services that enables its customers oil and gas companies, to access and to make more efficient and sustainable use of world's energy resources. It operates in over 100 countries and employs 47000 people and sales revenue over 27 Billion USD in 2013. Company received the project of Developing High Speed Jumbo pneumatic Drill. You are the project manager for the above said project. Comment on Business functions, Workforce planning, CSR, Project Human Resource Management in this context. [10]

Q3A. Annapurna Engineering Services is Reputed Brand in Asia for Wind Turbine manufacturing, Installation and servicing. It received a contract of establishing 1000 wind turbines in Indian Ocean. It has more than 450 suppliers for its various parts, assemblies etc. Identify the communication requirements in such project, which tools will you use? Prepare the communication management plan. [10]

Q3B. Ashish info systems is one of the Leading Organisations in Europe which provides the solutions related to Information Management Systems. It has received the project from WHO regarding creating a system for data collection, storage and analysis of the world's health records along-with the recent updates for serving the mankind in better way. The Idea is to Identify the challenges, Identify the Scope of work needed, Identify the Research requirements, Identify the ways to Prevent Spread of diseases, develop the strategies to Sponsor Research Institutes. Who will be the stakeholders for this project? What will be their requirements? Evaluate the importance of this requirements. How to treat the stakeholders. [10]

Q4A. Manasa Storewell is an Established Brand in European market. The Company decided to expand its business in South Asia. Therefore 5 locations are selected to establish the manufacturing set up with Modern manufacturing systems including Computer controlled Production Trains. Identify the risk in this project. Which Risk Mitigation Strategies will you use and why? How will you use FMEA. How will you use probability impact matrix?

Q4B. Write a short Note on the following. [10]

- i. Input Tools and Techniques in Project Time management
- ii. Input Tools and Techniques in Project Cost management

Q.5A. A company manufactures classroom furniture for students. State the types of allowances used in work measurement for such manufacturing environment. Explain computation of standard time in detail in this context. [10]

Q.5 B. Draw process charts for the traditional method and new method for payment towards electric bill. Compare them systematically and comment. [10]

Q6.A. Prepare the outline process chart for the manufacturing of the simple pencil sharpener along with packing. Analyse it and comment. [10]

Q6.B. Prepare the outline process chart for the manufacturing of the Assembly of nut, bolt and washer with standard specification for M12 threads. [10]

Q7.A. Explain the techniques of improving productivity. How will you measure productivity? [10]

Q7.B. What are the recording techniques? How are they used? What do you mean by MOST? Explain the significance of MOST. [10]

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# BHARATIYA VIDYA BHAVAN'S SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)  
MUNSHI NAGAR, ANDHERI (WEST), MUMBAI- 400 058

MASTER FILE

## END-SEMESTER

CLASS/SEM: B.E.(Mech) Sem VII

Total Marks: 100

SUBJECT: Machine Design II

B.E (Mech). Sem - VII

Duration: 4 Hour

Date: October 2014

- Attempt any FIVE out of seven questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Use of PSG data book is permitted.
- Assume suitable data if necessary.

1.	<p>a) A pair of straight bevel gears is mounted on shafts, which are intersecting at right angles. The number of teeth on the pinion and gear are 32 and 48 respectively. The pressure angle is <math>20^\circ</math>. The pinion shaft is connected to an electric motor rotating at 750 rpm. The service factor is 1.25. The pinion and gear are made of steel (<math>S_{UTS} = 640 \text{ N/mm}^2</math>) and heat treated to a surface hardness of 400 BHN. The gears are qualified as carefully cut gears. The module and face width are 8 and 80 mm respectively. Determine the maximum possible power rating of the electric motor if the factor of safety against bending as well as pitting is required to be 1.3. Use Buckingham formula to establish the effective load. (14)</p> <p>b) Derive the expressions for radial and axial forces acting on a tooth of helical gear in terms of the tangential force acting on the tooth. How do you determine the direction of axial force acting on the tooth of helical gear? (4)</p> <p>c) List commonly used materials for worm and worm wheel. Explain the basis for selecting these materials. (2)</p>
2.	<p>a) A pair of worm gears (<math>20^\circ</math> normal pressure angle) is designated as 1/30/10/10. The input speed of worm shaft is 900 rpm. The worm shaft rotates in both directions. The worm wheel is made of chill cast bronze with ultimate tensile strength of 450 MPa. The worm is hardened steel (over 500 BHN on surface). Determine the maximum input power transmitting capacity based on beam and wear strength. Consider factor of safety as 2.0. Perform thermal calculations and calculate the approximate temperature of the oil in gear box. Consider ambient temperature as <math>25^\circ \text{C}</math>. (16)</p> <p>b) Discuss advantages and disadvantages of internal gears over the external gears. Briefly explain how the procedure for design of internal gears differs from the one for design of external gears. (4)</p>

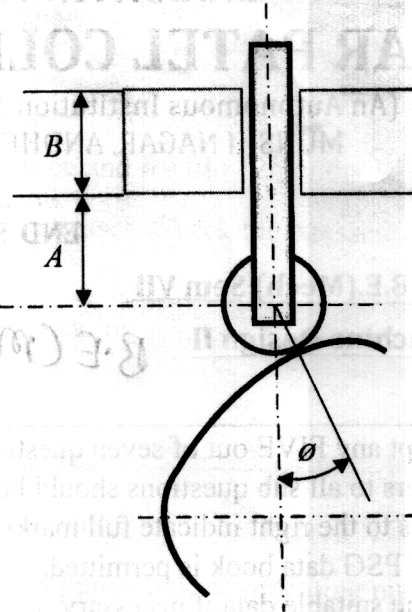


3. a) For a cam roller-follower mechanism prove that the follower will jam if the pressure angle exceeds

$$\phi_{\max} = \tan^{-1} \left[ \frac{B}{(2A + B)\mu} \right]$$

where  $\mu$  is coefficient of friction and A and B are dimensions shown in the figure.

Note: Include derivation of the necessary expressions for the force analysis of cam.



(4)

- b) A helical spring loaded cam uniformly rotates at 750 rpm with a translating roller follower. The cam profile is : (i) rise by 25 mm in 170°, SHM curve; (ii) dwell for 10°; (iii) fall same as rise and (iv) dwell for 10°. There is no offset provided to the translation axis. The radii of base circle and roller are 80 mm and 20 mm respectively. Mass of follower linkage is 1.5 kg and external force on the system is constant 50 N. Calculate the following. (i) Spring stiffness, (ii) torque on cam shaft at the instant of maximum total force acting on the cam, (iii) pressure angle at the instant of maximum velocity during rise motion.

(16)

4.

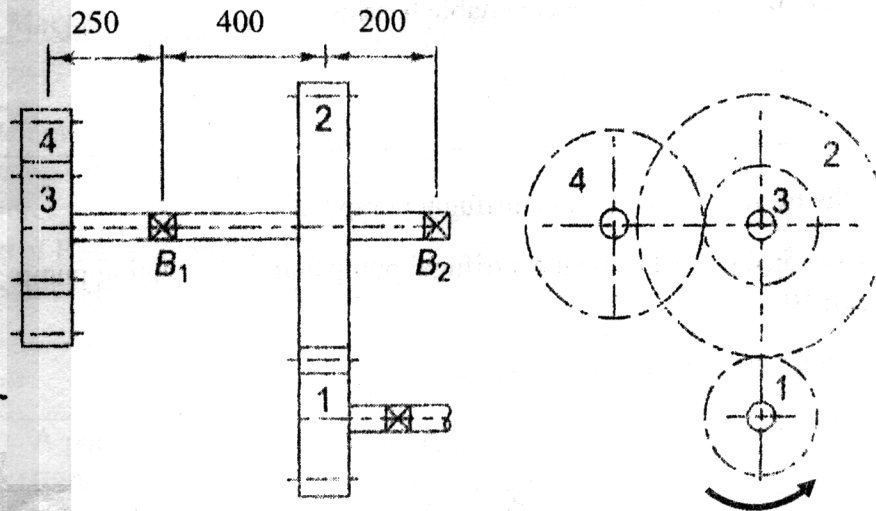
- a) Single row deep groove ball bearing No.6403 is used to support the lay shaft of four speed automobile gearbox. It is subjected to following loads in respective speed ratios:-

Gear	Axial load N	Radial load N	Time engaged
I	3250	4000	1%
II	500	2750	3%
III	50	2750	21%
IV	0	0	75%

The lay shaft is connected to the engine shaft and rotates at 1750rpm the bearing is expected to be in use for 4000hours of operation. Find out the reliability with which the life could be expected.

(10)

4. b) A train of spur gears with  $20^\circ$  full-depth involute teeth is shown in the figure. Gear 1 is the driving gear and transmits 25 kW power at 800 rpm to the gear train. The number of teeth on gears 1, 2, 3 and 4 are 40, 80, 30 and 60 respectively, while the module for all gears is 6 mm. Gears 2 and 3 are mounted on the same shaft. Gear 1 is rotating in counter-clockwise direction when seen from the left side of the page. Calculate (i) Tangential and radial components of tooth forces between gears 1 and 2 and gears 3 and 4; (ii) Resultant reactions at bearings B1 and B2. (10)



5. a) The following data is given for 3600 hydrodynamic bearing: (12)
- Journal diameter – 100mm
  - Journal speed – 1500rpm
  - Journal length – 50mm
  - Minimum oil film thickness – 15 microns
  - Viscosity of lubricant – 30CP
  - Specific gravity of oil – 0.86
  - Specific heat of lubricant – 2.09 KJ/Kg $^\circ$ C
  - Fit between journal and bearing is normal running H7e7 fit.
- Calculate load carrying capacity of bearing
1. The coefficient of friction
  2. The power lost in friction
  3. Total flow rate of lubricant
  4. The side leakage
  5. The temperature rise.
- b) Compare the rolling and sliding contact bearings in respect of the following factors. (8)
- Magnitude of load 2) Nature of load 3) speed 4) life 5) frictional loss 6) space requirement 7) positional accuracy 8) Noise 9) cost

6.	<p>The following specifications refer to an EOT crane:</p> <p>Application – Class II</p> <p>Load lifted – 9 Tons</p> <p>Hoisting speed – 7m/min</p> <ol style="list-style-type: none"> <li>1. Select suitable type and size of the wire rope and for life 12months</li> <li>2. Select standard hook material and design stresses. Check the stresses induced at most critical area.</li> <li>3. Design the pulley axel and select suitable bearing</li> <li>4. Design the cross piece with bearing</li> </ol>	<p>(6)</p> <p>(6)</p> <p>(5)</p> <p>(3)</p>
7.	<ol style="list-style-type: none"> <li>a) What is the need of priming of centrifugal pump?</li> <li>b) Write down difference between centrifugal pump and reciprocating pump (minimum 10 points)</li> <li>c) What do you mean by cavitation in pumps?</li> <li>d) Explain any two types of seal?</li> </ol>	<p>(5)</p> <p>(6)</p> <p>(3)</p> <p>(6)</p>
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**BHARATIYA VIDYA BHAVAN'S**  
**SARDAR PATEL COLLEGE OF ENGINEERING**

(An Autonomous Institution Affiliated to University of Mumbai)

MUNSHI NAGAR, ANDHERI (WEST), MUMBAI- 400 058

*BEC (Mech), Sem - VII, Re-exam.*

**RE-EXAMINATION**

*master*

**CLASS/SEM: B.E.(Mech) Sem VII**

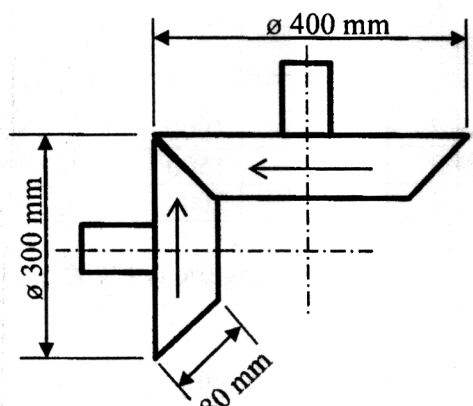
**Total Marks: 100**

**SUBJECT: Machine Design II**

**Duration: 4 Hour**

**Date: December 2014**

- Attempt any FIVE out of seven questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Use of PSG data book is permitted.
- Assume suitable data if necessary.

1.	<p>a) A pair of parallel helical gears consists of a 30 teeth pinion meshing with a 120 teeth gear. The pinion rotates at 1000 rpm. The normal pressure angle is <math>20^\circ</math>, while the helix angle is <math>25^\circ</math>. The face width is 60 mm and the normal module is 5 mm. The pinion as well as the gear is made of steel with ultimate tensile strength of 700 MPa and heat treated to a surface hardness of 400 BHN. The service factor and the factor of safety are 1.25 and 2.5 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. (12)</p> <p>b) A pair of bevel gears transmitting 10 kW at 500 rpm is shown in the figure. The pinion is driving the gear. The pressure angle is <math>20^\circ</math>. Determine the components of gear tooth forces and indicate them on free body diagram of pinion and gear. (8)</p>	
		
2.	<p>a) A pair of worm gears (<math>20^\circ</math> normal pressure angle) is designated as 2/40/10/8. The input speed of worm shaft is 1200 rpm. The worm wheel is made of centrifugally cast bronze with ultimate tensile strength of 350 MPa. The worm is steel (hardness of 250 HB minimum on surface). Determine the maximum input power transmitting capacity based on beam and wear strength. Consider factor of safety as 1.5. The worm shaft rotates in one direction only. (12)</p>	



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	<p>b) Explain the meaning and significance of terms “interference” and “backlash” in the context of gear design.</p> <p>c) Describe the thermal considerations involved in the design of worm gear system.</p>	(4) (4)																																								
3.	<p>a) A helical spring loaded cam uniformly rotates at 900 rpm with a translating roller follower. There is no offset provided to the translation axis. The cam profile is : (i) rise by 30 mm in 150°, parabolic curve; (ii) dwell for 30°; (iii) fall same as rise and (iv) dwell for 30°. The radii of base circle and roller are 90 mm and 25 mm respectively. Mass of follower linkage is 2.5 kg and external force on the system is constant 80 N. Calculate the following. (i) Spring stiffness, (ii) Maximum torque acting on cam shaft, (iii) pressure angle at the instant of maximum velocity during rise motion. Assume suitable pre-tension in the spring. Draw a neat sketch showing variation of inertia force, spring force and total force against the rotation angle of cam.</p> <p>b) Cams and followers can be classified on the basis of (i) motion of follower, (ii) surface of follower and (iii) shape of cam. Draw neat sketches to illustrate any four types of cam-follower system.</p>	(16) (4)																																								
4.	<p>a) A pair of precision cut spur gears with 20° full-depth involute teeth consists of a 24 teeth pinion meshing with 48 teeth gear. The pinion is connected to a 6 kW, 1440 rpm, diesel engine. Assume service factor as 1.25. The pinion as well as gear is made of steel with ultimate tensile strength of 800 MPa and surface hardness of 400 BHN. The module and face width of gears are 5 mm and 50 mm respectively. Determine the factor of safety for bending and pitting failures using Buckingham’s equation for dynamic load.</p> <p>b) A single row deep groove ball bearing is subjected to work cycle given below:</p> <table border="1"><thead><tr><th>Sr. No</th><th>Fraction Of cycle</th><th>Axial load N</th><th>Radial load N</th><th>Service factor</th><th>Speed r.p.m.</th></tr></thead><tbody><tr><td>1</td><td>1/10</td><td>1200</td><td>2000</td><td>3.0</td><td>400</td></tr><tr><td>2</td><td>1/10</td><td>1000</td><td>1500</td><td>1.5</td><td>500</td></tr><tr><td>3</td><td>1/5</td><td>1500</td><td>1000</td><td>2.0</td><td>600</td></tr><tr><td>4</td><td>3/5</td><td>2000</td><td>1200</td><td>1.0</td><td>800</td></tr></tbody></table> <p>If the desired rating life is 15000 hours, select the bearing from the following Data:</p> <table border="1"><thead><tr><th>Bearing No</th><th>6015</th><th>6215</th><th>6315</th><th>6415</th></tr></thead><tbody><tr><td>Dynamic capacity ‘C’ kN</td><td>31</td><td>52</td><td>90</td><td>120</td></tr></tbody></table> <p>Assume radial and axial load factors to be 1.0 and 1.5 respectively and inner race rotates.</p>	Sr. No	Fraction Of cycle	Axial load N	Radial load N	Service factor	Speed r.p.m.	1	1/10	1200	2000	3.0	400	2	1/10	1000	1500	1.5	500	3	1/5	1500	1000	2.0	600	4	3/5	2000	1200	1.0	800	Bearing No	6015	6215	6315	6415	Dynamic capacity ‘C’ kN	31	52	90	120	(10) (10)
Sr. No	Fraction Of cycle	Axial load N	Radial load N	Service factor	Speed r.p.m.																																					
1	1/10	1200	2000	3.0	400																																					
2	1/10	1000	1500	1.5	500																																					
3	1/5	1500	1000	2.0	600																																					
4	3/5	2000	1200	1.0	800																																					
Bearing No	6015	6215	6315	6415																																						
Dynamic capacity ‘C’ kN	31	52	90	120																																						
5.	<p>a) The following data is given for 360° hydrodynamic bearing:</p> <p>Journal diameter – 50mm</p> <p>Journal speed – 1490rpm</p> <p>Journal length – 50mm</p>	(12)																																								

	<p>Radial load-3.2KN  Radial clearance-0.05  Viscosity of lubricant-25CP  Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing. Calculate :</p> <ol style="list-style-type: none"> <li>The coefficient of friction</li> <li>The power lost in friction</li> <li>Flow requirement in l/min</li> <li>The temperature rise.</li> <li>Minimum oil film thickness</li> </ol> <p>c) Explain any six different types of rolling contact bearing with neat sketch.</p>	(8)
6.	<p>The following specifications refer to an EOT crane:  Application – Class II  Load lifted – 12 Tons  Hoisting speed – 10m/min</p> <ol style="list-style-type: none"> <li>Select suitable type and size of the wire rope and for life 10months</li> <li>Select standard hook material and design stresses. Check the stresses induced at most critical area.</li> <li>Design the pulley axel and select suitable bearing</li> <li>Design the cross piece with bearing</li> </ol>	<p>(6)</p> <p>(6)</p> <p>(5)</p> <p>(3)</p>
7.	<ol style="list-style-type: none"> <li>Write short note on construction of wire rope?</li> <li>Write down difference between centrifugal pump and reciprocating pump (minimum 10 points)</li> <li>Why delivery valve of centrifugal pump has to be closed while starting large pumps?</li> <li>Write short note on oil seals?</li> </ol>	<p>(6)</p> <p>(6)</p> <p>(5)</p> <p>(3)</p>
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29/10/19

**BHARTIYA VIDYA BHAVAN'S**  
**SARDAR PATEL COLLEGE OF ENGINEERING**

[An Autonomous Institution Affiliated to University of Mumbai]

MUNSHI NAGAR, ANDHERI(WEST), MUMBAI-400 058

**END SEMESTER**

CLASS/SEM: B.E(Mech)/VII

SUBJECT: Renewable Energy Sources and Utilization

TOTAL MARKS:100

DURATION: 3 HOUR

*B.E (Mech), Sem - VII*

1. Answer any **Five** questions out of **Seven** questions.
2. Figures to the right indicate full marks.
3. Assume suitable data and justify the same.

*master*

Q.1. An industrial solar energy system is installed at a cost of Rs 400000 for preheating boiler feed water. The cost of fuel saved in the first year is Rs 56000. This cost increases at the rate of 10 per cent in the subsequent years. The entire initial cost of Rs 400000 is financed through a loan borrowed at the rate of 11 per cent. In order to encourage the use of solar energy, the government permits depreciation at the high rate of 75 percent in the first year and the remaining 25 per cent in the second year. The corresponding tax rate is 60 percent. The annual repayment of loan is not in equal installments, but is adjusted every year to such a value that the annual savings is zero. This is done till the loan is fully paid. No tax savings is allowed on the interest component of the loan repayment. The annual expense associated with maintenance and other recurring items is Rs 11000 in the first year. This expense increases at the rate of 6 per cent every year. Calculate the cumulative savings over a period of 8 years assuming a discount rate of 10 per cent. Also calculate the payback period for the system. [20]

Q.2.a) Explain with neat sketch procedure for analysis of liquid flat plate collector. [10]

b) What do you understand by concentration? What are the important terms for design of concentrating collectors? [10]

Q.3. a) The dark current density for silicon solar cell at 40 °C is  $3.6 \times 10^{-8} \text{ A/m}^2$  and the short circuit current density is  $220 \text{ A/m}^2$ . Calculate the voltage and current density that maximizes the power of the cell. What would be the corresponding maximum power output per unit cell area and corresponding conversion efficiency if the global solar radiation incident on the cell is  $850 \text{ W/m}^2$ ? Calculate the cell area required for an output of 36 W. [10]

b). Explain the working of fuel cell? Also mention its application with advantages and disadvantages. [10]

Q.4.a) A multi-blade wind mill lifts  $1.03 \text{ m}^3/\text{h}$  of water through a head of 28 m when the wind speed is 3.3 m/s. Calculate the power coefficient if the rotor diameter is 4.5 m, given that the transmission efficiency is 0.95 and pump efficiency is 0.7. [6]

b) Explain the method of Bio-ethanol and Bio-diesel production in detail. [14]

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Q.5.a) Explain the working principle of photovoltaic Solar cell. Also mention its advantages and disadvantages [10]

b) Explain the various types of concentrating collectors with diagram. [10]

Q.6.a) Explain the method of extraction of geothermal heat source. List the application of geothermal heat source with its advantages and disadvantages. [10]

b) Explain Biomass Gasification process in detail. [10]

Q.7. Write short notes on [Any four] [20]

- a) Significance of small hydro power plant
- b) Pyranometer
- c) Ocean Thermal Energy Conversion System (OTEC)
- d) Selective Surfaces for liquid Flat plate collectors.
- e) Wave energy