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Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

Re-Examination
June 2016

Max. Marks: **100** | Duration: **4 Hours**
Class:**B.Tech.** Semester: **VII** | Program: **B.Tech. in Mechanical Engineering**
Name of the Course: **Machine Design II** | Course Code: **ME 401**

Master file.

Instructions:

- Question no. **1** is **compulsory**. Attempt any **four** out of remaining six questions.
- Answers to all sub questions should be grouped together.
- Use of PSG Design Data book is allowed. Assume suitable data if necessary.

			Max. marks	CO No.	Module No.
Q1	a)	Explain advantages of helical gears over spur gears. What is the main disadvantage of single helical gear and what is the remedy? State applications of helical gears.	**(4)**	*1*	*1*
	b)	Describe various considerations involved in design of two stage gear box.	**(4)**	*2*	*2*
	c)	Define static and dynamic load carrying capacity of ball bearings. How these parameters are used in selection of ball bearing for a given service?	**(4)**	*1*	*3*
	d)	What are the desirable properties of material used for hydrodynamic bearing? State some of the materials commonly used for this purpose.	**(4)**	*1*	*4*
	e)	Discuss different types of cams used for industrial applications with neat sketches.	**(4)**	*1*	*5*
Q2	a)	Your organization is planning to introduce a series of gear boxes for machine tool industry. List important design parameters and propose a procedure to design each member of the product series.	**(8)**	*2,3*	*2*
	b)	A single-row deep groove ball bearing is subjected to a 35 second work cycle that consists of following two parts.	**(12)**	*1*	*3*

	Part I	Part II
Duration (seconds)	15	20
F_r (kN)	35	8
F_a (kN)	8	4
Speed (rpm)	550	1150

The bearing has $C_0 = 44$ kN and $C = 62$ kN. The inner race of bearing is rotating. Calculate expected life of bearing in hours.

Q3 a) A pair of parallel helical gears consists of a 32 teeth pinion meshing with 160 teeth gear. The pinion rotates at 650 rpm. The normal pressure angle is 20°, helix angle is 25°. The face width is 52 mm and the normal module is 4 mm. The pinion as well as gear is made of forged steel (S_{UTS} = 750 MPa, S_{YS} = 600 MPa) and heat treated to surface hardness of 380 BHN. The service factor and factor of safety are 1.20 and 2.2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of the gears. **(10)** *1* *1*

b) The following data is given for a full hydrodynamic bearing. **(10)** *1* *4*

Radial load = 27 kN
Journal speed = 950 rpm
Unit bearing pressure = 2.25 MPa
L/D ratio = assume suitable
Viscosity of lubricant = 22 cP
Class of fit = H7e7

Calculate (i) dimensions of bearing, (ii) minimum film thickness and (iii) requirement of oil flow.

Q4 a) Describe different types of rolling contact bearings with neat sketches. **(4)** *1* *3*

b) Write a short note on hydrostatic bearings. **(4)** *1* *4*

c) Describe construction of snatch block assembly for an EOT crane with neat sketch and mark main components such as, rope, pulley, cross-block, hook, thrust bearing, side-plates, etc. Explain with necessary equations, the procedure used to select size of rope, hook and sheave for a given load capacity of snatch block. **(12)** *3* *7*

Q5 a) A pair of bevel gears with 20° pressure angle consists of a 28 teeth pinion meshing with 42 teeth gear. The modules is 6 mm and face width is 30 mm. The material for pinion and gear is steel (tensile strength S_{UTS} = 800 MPa). The gear teeth are precision cut. The pinion rotates at 380 rpm and receives 1.25 kW power from an electric motor. The starting torque of motor is 110% of the rated torque. Determine factor of safety against bending failure. **(8)** *1* *1*

b) Describe important components of a centrifugal pump with a neat sketch. Explain the factors involved in design of pump shaft, impeller, volute casing and selection of electric motor. **(12)** *3*

Q6 a) Explain the thermal considerations employed in the design of worm gears. State advantages of work gears over other types. **(5)** *1* *1*

b) A helical spring loaded cam rotates at 750 rpm with a translating roller follower. The cam profile is: (a) rise by 18 mm in 150°, constant acceleration curve; (b) dwell for 30°; (c) fall same as rise and (d) dwell for 30°. There is no offset provided to the translation axis. The radii of base circle and roller are 50 mm and 15 mm respectively. Mass of follower linkage is 0.65 kg and external force on the system is constant 25 N. Calculate the following. **(15)** *1* *5*

(i) Spring stiffness, (ii) roller pin diameter, (iii) maximum torque on cam shaft.

Q7 a) What is virtual or formative bevel gear? Derive expression for virtual number of teeth in terms of pitch angle of bevel gear. **(5)** *1* *1*

b) Discuss different types of failures and the associated remedies for rolling contact and sliding contact bearings. **(5)** *1* *3,4*

c) Write a short note on static and dynamic mechanical seals. Support your answer with neat sketches. **(5)** *1* *4*

d) Compare merits and demerits of centrifugal pumps against the reciprocating pumps. **(5)** *3* *6*

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Sardar Patel College of Engineer

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Munshi Nagar, Andheri (West), Mumbai – 400058.

Re-Exam
June 2016

Max. Marks: 100
Class: BTech
Semester: VII

Duration: 3Hours
Program: Mechanical Engineering
Course Code : ME 402

Name of the Course: Renewable Energy Sources and Utilization

Instructions:

1) Question number **ONE** is compulsory and solve any **FOUR** questions out of remaining six.
2) Answers to sub questions should be grouped together.
3) Assume suitable data and justify the same.

Master file.

Question No		Maximum Marks	Course Outcome Number	Module No.
Q.1(a)	Explain the terms: (i) concentration, (ii) aperture, (iii) area concentration ratio, (iv) intercept factor and (v) acceptance angle.	20	1	II
(b)	Explain different types of wind turbine rotors.			IV
(c)	Discuss the use of selective surfaces.			II
(d)	Explain the working of Fuel Cell.			VII
Q2(a)	Explain the detail performance analysis of a liquid flat plate collector for steady state situation.	10	1	II
(b)	Explain various types of concentrated collectors with neat sketches.	10	1	II
Q3(a)	Explain the working principle of photovoltaic solar cell. Also discuss about its performance characteristics.	10	1	I
(b)	A photovoltaic cell has an open circuit voltage of 0.6 V and a short circuit current of 250 A/m^2 at a cell temperature of 40°C. 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?	10	2	II
Q4(a)	Calculate the energy content of the wind per square meter for the following situation: Location : Indore Month : November Take ρ for air = 1.20 kg/m^3. Also calculate the actual energy available for a wind machine for which the cut-in speed is 14 km/h, the design speed is 31 km/h and the cut out speed is 90 km/h. The percentage frequency distribution of hourly wind speed is given in the table.	12	2	IV

	Interval	Nov	Interval	Nov	Interval	Nov	Interval	Nov			
	00	6.9	10-12	6.2	22-24	4.5	34-36	0.3			
	00-02	5.9	12-14	7.9	24-26	2.9	36-38	0.1			
	02-04	4.1	14-16	10.4	26-28	1.5					
	04-06	4.5	16-18	13.6	28-30	1.1					
	06-08	4.7	18-20	12.9	30-32	0.7					
	08-10	1.7	20-22	9.7	32-34	0.4					
(b)	Draw neat sketch of pyranometer and explain its working.								8	1	II
Q5(a)	What is small hydro power plant? Write advantages and limitations of small hydro power plants.								8	1	V
(b)	Explain how geothermal energy is extracted. Also list its applications, advantages and disadvantages.								12	3	VI
Q6(a)	What is wave energy? Explain various systems of wave energy conversion								10	3	V
(b)	Comment on India's energy production by various means.								10	1	I
Q7(a)	Explain Biomass Gasification process in detail.								10	1	VII
(b)	Explain the method of Bio-ethanol and Bio-diesel production in detail.								10	1	VII

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BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

Munshi Nagar, Andheri (West), Mumbai 400 058

(A Government Aided Autonomous Institute)

RE-Examination June-2016

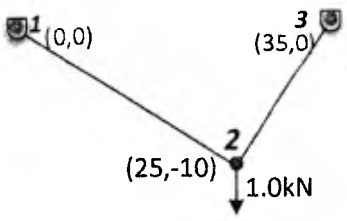
Course: ME403 – Finite Element Analysis

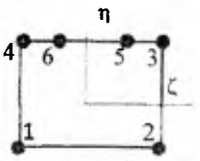
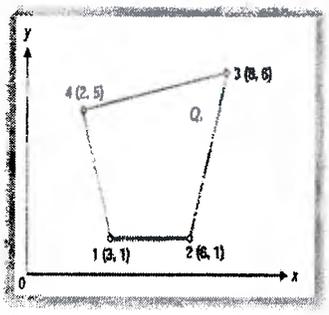
Duration: 4 hours | Marks: 100

Class/Branch: Final year B. Tech. (Mechanical) | Semester: VII

Note:

- **Question No 1 is compulsory**
- **Attempt any four questions out of remaining six.**
- ~~Assume suitable data if required and state it clearly.~~ Master file.
- Answers to all sub-questions should be grouped together.

Q.no.		Max. Marks	Module	COs
1	Answer the following:			
	a) List the five typical areas of engineering where the FEM is applied.	3	M1	Co1
	b) State the advantages of FEA over other numerical analysis methods.	3	M1	Co1
	c) List the steps involved in finite element analysis using any software.	4	M1	Co1
	d) Define the term finite element. What does discretization mean in FEM? List four common types of finite element.	5	M4	Co1
	e) State and explain mathematical expression for weighted residual method. Classify the WRM.	5	M3	Co1
2	A plane truss is subjected to a downward vertical load at node 2. Determine deflection at node 2 and axial stress and strain in each element. Take for both elements $A=50cm^2$, $E= 210GPa$. 	20	M5	Co2
3	A CST element having nodal coordinates (1,3), (3,3), (2,5) for nodes 1,2 and 3 respectively and thickness 2mm; upon loading the nodal deflection (in microns) found to be (2,1), (3,2) and (5,3) at nodes 1,2 and 3 respectively. Determine: i) Displacement at P(2,2); ii) The strain displacement relation matrix; iii) The strains ε_x, ε_y and γ_{xy}. iv) The element stresses (plain strain).	20	M7	Co3

4	a) Using serendipity concept, find the shape function for the element shown in fig., having co-ordinates (1/3,1) and (-1/3,1) for nodes 5 and 6 respectively. 	10	M6	Co1
	b) For isoparametric quadrilateral element as shown in adjucent fig.:  i)Determine the local co-ordinates (ζ,η) for point Q having cartesian coordinates (7,4). ii)Evaluate Jacobian matrix at $(1/\sqrt{3}, 1/\sqrt{3})$.	10	M6	Co1
5	a) Derive the shape functions for beam element.	10	M3	Co2
	b) Derive consistant nodal load vector for vertically hanging quadratic bar element. Take the load as body force due to gravity, expressed as q= ρAg.	10	M3 M5	Co2
6	Analyze completely the taper bar, hanging under its own weight, converting it into a stepped bar with three elements. $A = A_0 + A_1 x^2$; $A_0 = A(0) = 50\ cm^2$; $A_L = A(L) = 20\ cm^2$; $\vartheta = 80\ kN / m^3$; E = 200 GPa; L = 120 cm. Find stress, strain in each element.	20	M5	Co2
7	Write short note on:			Co1
	a) Stiffness matrix of 1-D problem	5	M3	
	b) Types of Boundary Conditions.	5	M4	
	c) Cholesky factorisation.	5	M2	
	d) Numerical integration and Gauss Quadrature.	5	M2	

Additional Data:

$$\therefore [k] = \frac{EI}{L^3}\begin{bmatrix} 12 & 6L & -12 & 6L \\ 6L & 4L^2 & -6L & 2L^2 \\ -12 & -6L & 12 & -6L \\ 6L & 2L^2 & -6L & 4L^2 \end{bmatrix}$$

$$\frac{E}{1-\mu^2}\begin{bmatrix} 1 & \mu & 0 \\ \mu & 1 & 0 \\ 0 & 0 & \frac{1-\mu}{2} \end{bmatrix}$$

$$\frac{E}{(1+\mu)(1-2\mu)}\begin{bmatrix} 1-\mu & \mu & 0 \\ \mu & 1-\mu & 0 \\ 0 & 0 & \frac{1-2\mu}{2} \end{bmatrix}$$

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SARDAR PATEL COLLEGE OF ENGINEERING

GOVERNMENT AIDED AUTONOMOUS INSTITUTE

ANDHERI (WEST), MUMBAI - 400 058.

Re Exam

June 2016

Max. Marks: 100	**Duration: 03 hrs**
Class: B.Tech Mechanical	**Semester: VII**
Name of Course: Elective – I **Computational Fluid Dynamics**	**Program: B.Tech Mechanical Engineering**
Course Code: ME - 408	

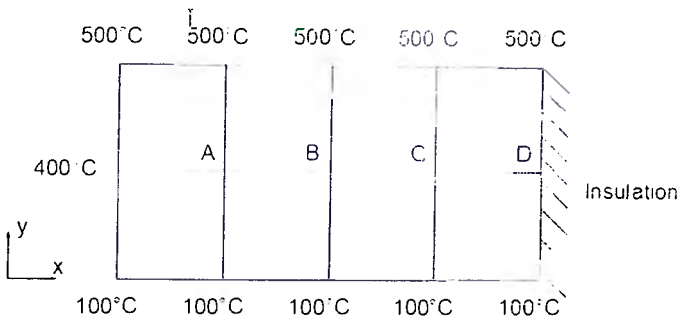
Instructions: 1. Question no. 1 is Compulsory

2. Attempt any four questions out of remaining six.

3. Figures to right indicate full marks

4. Assume suitable data if necessary

Q. 1 (a)	Write Short Notes on: (i) Experimental Approach (ii) Analytical Approach	10
(b)	Derive the Continuity Equation for an infinitesimally small moving fluid element. State all the assumptions made clearly.	10
Q. 2 (a)	Explain the CFD Methodology?	10
(b)	Explain different types of Boundary Conditions with example.	06
(c)	State whether the following equations are non linear or linear. Justify your answer i) $\frac{\partial T}{\partial t} + \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} = 0$ ii) $\frac{d^2T}{dx^2} = \frac{hP}{KA}(T-T_\infty)$	04
Q. 3 (a)	Solve the following equations by Gauss Elimination & Gauss Seidel method and Compare the Results. $2.25x_1 - x_2 = 1$ $-x_1 + 2.25x_2 - x_3 = 0$ $-x_2 + 2.25x_3 - x_4 = 0$ $-2x_3 + 2.25x_4 = 0$	10
(b)	Write Short notes on: (i) Relaxation methods (ii) Condition number	10

Q. 4 (a)	Explain Explicit Approach with the help of one dimension unsteady state heat conduction problem. Derive the stability criteria for the explicit approach.	10
(b)	Consider a solid body shown in figure, that is initially at a uniform temperature of 100 °C. For times $t \geq 0$, the boundary temperatures are maintained at the values given in the figure. Derive the Temperature Distribution equation by explicit method. Find the temperatures of the grid points A, B, C and D considering stability criteria after 4 time steps. 	10
Q. 5 (a)	Explain FOU scheme State the limitation of FOU scheme and derive the stability criteria for FOU scheme.	10
(b)	Derive steady one dimensional convection diffusion equation by Finite difference Method? State its stability criteria?	10
Q. 6 (a)	Explain the stream function Vorticity method. Give the Algorithm for Solution by Stream function-Vorticity Method.	06 04
(b)	Explain Staggered Grid? State the steps for Simple Algorithm.	06 04
Q. 7 (a)	Explain why turbulence modelling is required? Give the Classification of Turbulence models	06 04
(b)	Write short notes on: (a) k-e model (b) $k - w$ model	 05 05
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