Tanta University | Department: Production Engineering & Mechanical Design | Faculty of Engineering

Total marks: 85 Marks

Course Title: Theory of Vibration
Course Code: MPD3115
Year: 3rd Year Mech. Power

Final Exam

Date: 17-1- 2016
Allowed time: 3 hrs
No. Of pages: 3

Answer all the following questions: (Assume any missing data)

Q1. State which of the following statements is true and which is false: **(20 marks)**

a. The amplitude of an undamped system will not change with time.

b. A system vibrating in air can be considered a damped system.

c. For an undamped system, the velocity leads the displacement by $\frac{\pi}{2}$.

d. Free vibrations defined as no forcing excitation (representative of natural dynamics; needs two forms of energy storage and interchange)

e. The damped frequency can be zero in some cases.

f. Damping reduces the amplitude ratio for all values of the forcing frequency.

g. The unbalance in a rotating machine causes vibration.

h. The vibration of a system depends on the coordinate system.

i. The response will be harmonic if excitation is harmonic.

j. During free vibration, different degrees of freedom oscillate with different amplitudes.

k. The amplitudes and phase angles are determined from the boundary conditions of the system.

l. The number of degrees of freedom of a vibrating system depends only on number of masses.

Q2. **(15 marks)**

a. The crate, of mass 250 kg, hanging from a helicopter (shown in Fig. 1(a)) can be modeled as shown in Fig. 1(b). The rotor blades of the helicopter rotate at 300 rpm. Find the diameter of the steel cables so that the natural frequency of vibration of the crate is at least twice the frequency of the rotor blades. Assume that the steel Young's modulus is 200 GPa

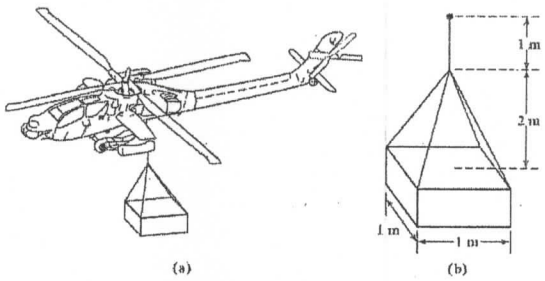

Fig. 1

Q3. **(15 marks)**

a. The system shown in Figure 2 has a natural frequency of 5 Hz for the following data: m = 10 kg, J_0 =5 kg-m^2, r_1 = 10 cm, r_2 = 25 cm. When the system is disturbed by giving it an initial displacement, the amplitude of free vibration is reduced by 80 percent in 10 cycles. Determine the values of k and c.

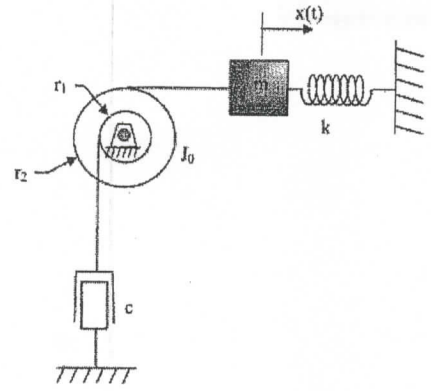

Fig. 2

Q4. **(15 marks)**

a. The schematic diagram of a Francis water turbine is shown in Fig. 3. In which water flows from **A** into the blades **B** and down into the tail race **C**. The rotor has a mass of 250 kg and an unbalance (me) of 5 kg-mm. The radial clearance between the rotor and the stator is 5 mm. The turbine operates in the speed range 600 to 6000 rpm. The steel shaft carrying the rotor can be assumed to be clamped at the bearings. Determine the diameter of the shaft so that the rotor is always clear of the stator at all the operating speeds of the turbine. Assume damping to be negligible. (**Note that**: Use the expression for the stiffness of a cantilever beam).

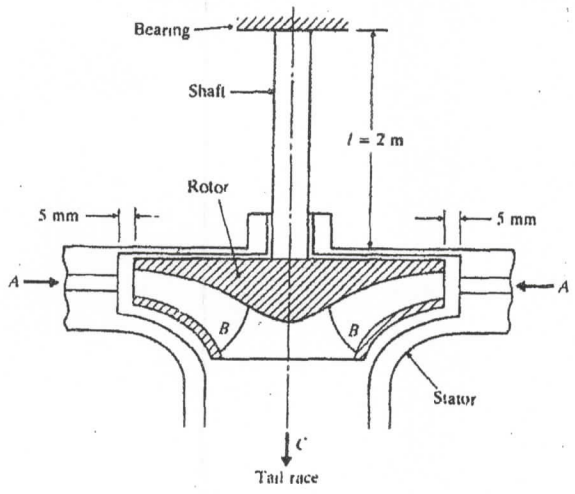

Fig.3

Q5. **(15 marks)**

a. The schematic diagram of a marine engine connected to a propeller through gears is shown in Fig. 4. The mass moments of inertia of the flywheel, engine, gear 1, gear 2, and the propeller (in kg.m^2) are 9000, 1000, 250, 150, and 2000, respectively. Find the natural frequencies and mode shapes of the system in torsional vibration.(Assuming a shear modulus of 8×10^9 N/m^2 for steel)

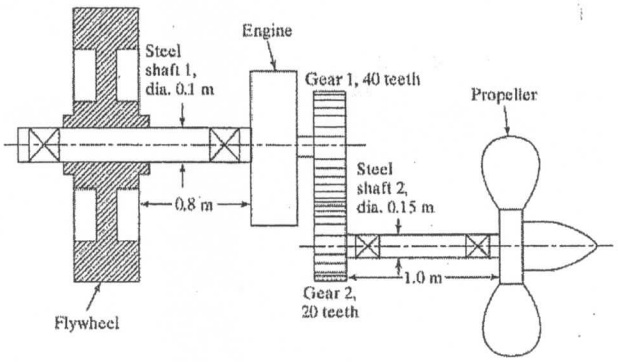

Fig. 4

Q6. **(10 marks)**

Imagine that you are a Vibrations Engineer working for ARAMCO company, where you are investigating the properties of a foundation that will be used to support an electric motor of weight mg =500 N. Your boss, Abdullah Joma'a, wants you to identify the following for the foundation:

a) The nature of damping provided by the foundation.

b) The damped and undamped natural frequencies of the motor/foundation combination.

c) The foundation stiffness and damping.

Thus you perform a free vibration tests whereby the motor supported by the particular foundation is released from rest with an initial displacement $x_0 = 8$ mm and the subsequent response is measured. The response is shown in Figure 5.

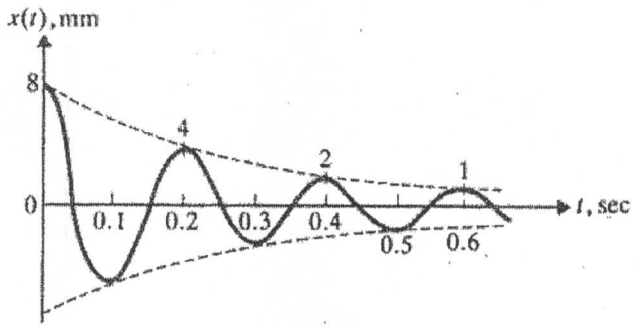

Fig.5

With my best wishes

Dr.Eng. Maher .R.Elsadaty

Tanta University
Faculty of Engineering
Production Engineering & Design Dept.
3rd Year Production Engineering & Design 2015/2016
Theory of Metal Cutting

MPD3116
Thursday, 21.01.2016
Time allowed : 3 hours
Final Grade : 100 Marks
Number of Pages: 1

Final Exam

Solve all questions

Question 1 : (36 marks)

Differentiate between the following: (use neat sketches if necessary)

a) The twist and the gun drill in the context of geometry, function, and tool motion. **(10 marks)**
b) Types of chip; showing the shape, the conditions that favor their formation, and their effect on the machining process. **(12 marks)**
c) HSS and ceramic tool materials; the composition, the types and the characteristics. **(8 marks)**
d) Tool angles of a single point tool and the role of each. **(6 marks)**

Question 2 : (24 marks)

a) Talk about three main factors influencing machining operations. **(6 marks)**
b) Draw a schematic of a single point orthogonal cutting and mention all its features. **(6 marks)**
c) Define the cutting ratio and describe one experimental method to determine it. **(6 marks)**
d) Derive the shear angle in terms of cutting ratio r and rake angle α. **(6 marks)**

Question 3 : (20 marks)

An orthogonal cutting operation is being carried out under the following conditions: $t_0 = 0.1$ mm, $t_c = 0.18$ mm, width of cut = 4 mm, $v = 1.5$ m/s, rake angle = 12°, $F_c = 600$ N, and $F_t = 150$ N. **(20 marks)**

i. Calculate the shear angle.
ii. What is the total power necessary to accomplish this process?
iii. Get the power dissipated in the shear plane.
iv. If the cutting tool has n = 0.4 and C = 200, calculate the tool life for the given speed.
v. Write down the components of the total cost per cutting piece and mention how each one is calculated.

Question 4 : (20 marks)

a) Temperature rise is an important phenomenon in metal cutting. **(8 marks)**
i. Draw a temperature distribution of a single point cutting process.
ii. What are the sources of heat in machining?
iii. What types of coolant used in cutting processes?

b) Differentiate between flank wear and crater wear by:
place of occurrence, shape and reasons for occurrence **(9 marks)**

c) Show through a plot the variation of various costs per piece against the cutting speed and hence show in the same plot the variation of total cost. **(3 marks)**

مع تمنياتنا بالتوفيق و النجاح

د. نادر نبيل د. محمود أحمدين

	TANTA UNIVERSITY FACULTY OF ENGINEERING DEPARTMENT OF MECHANICAL POWER ENGINEERING			
	EXAMINATION FOR FRESHMEN (2016 YEAR), STUDENTS OF 3th GRADE MECHANICAL PRODUCTION			
	COURSE TITLE:	Refrigeration& Air conditioning		COURSE CODE: MEP3153
DATE:	January 24, 2016	TERM: 1st	TOTAL ASSESSMENT MARKS: 50	TIME ALLOWED (HOURS): 3

Answer the following questions. Assume any necessary assumptions. Use of tables and charts of Refrigeration& Air conditioning is allowed.

Question (1) (5 Marks)

a) Define Refrigeration and Mention its Applications?

b) What is the difference between a heat pump and a refrigerator?

Question (2) (8 Marks)

A simple air cooled system is used for an aeroplane to take a load of 10 tons. Atmospheric temperature and pressure is 25°C and 0.9 atm respectively. Due to ramming the pressure of air is increased from 0.9 atm, to 1 atm. The pressure of air leaving the main compressor is 3.5 atm and its 50% heat is removed in the air-cooled heat exchanger. Lastly the air is passed through cooling turbine and is supplied to the cooling cabin where the pressure is 1.03 atm. Assuming isentropic efficiency of the compressor and turbine are 75% and 70%, The temperature of air leaving the cabin should not exceed 25°C.

Find:

1) Power required taking the load in the cooling cabin
2) COP of the system.

Question (3) (8 Marks)

a) With drawing explain why should a flash tank be used in the vapor compression refrigeration cycle?

b) Vapor compression refrigeration system based on refrigerant R 134a operates between an evaporator temperature of –25°C and a condenser temperature of 50°C. Assuming isentropic compression, find:

a) COP of the system
b) Work input to compressor

Question (4) (9 Marks)

a) Discuss the advantages and applications of multi-evaporator systems compared to single stage systems.

b) In a R22 based refrigeration system, a liquid-to-suction heat exchanger (LSHX) with an effectiveness of 0.65 is used. The evaporating and condensing temperatures are 7.2oC and 54.4oC respectively. Assuming the compression process to be isentropic, find:

a) Specific refrigeration effect,
b) Specific work of compression,
c) COP of the system,
d) Temperature of vapor at the exit of the compressor.

Question (5) (20 Marks)

a) Define each of:

1- Relative humidity (Φ), 2- Humidity ratio (W), 3- Dew-point temperature

b) An office 10m×6m×3m height (with the shorter wall oriented facing north direction) is to be conditioned. The office is located in top floor of the building. The building site is 40° North latitude. West wall separate the office from conditioned space otherwise south and east walls separate the office from unconditioned space. The north wall is Side Street. All walls, floor and roof are constructed from 100-mm face brick, 50-mm insulation and 100-mm concrete. The office has single window facing west with 3m×1.5m and 6-mm single glass having light color medium weave shading. The average number of occupants in space is 6 person's works from 8.00 Am till 4.00 Pm. Lighting is unvented and unsuspended fluorescent lamps, number of lamps are 8 and each lamp has 60 watt. Inside design condition is 25 ℃ and outdoor air is assumed to be 43 ℃. Neglect all other loading and calculate the space total load and the sensible heat factor (SHF). Base your calculations on 21 August, 2.00 Pm O'clock

EXAMINERS	Dr. Magda El-Fakharany	

Best wishes

TANTA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF: **Production Engineering & Mech. Design Dep.**
EXAMINATION (3 YEAR) STUDENTS OF Production ENGINEERING

COURSE TITLE: **Mechanical Design (2)**			COURSE CODE: PMD3219
DATE:26/1/2016	TERM: **First term**	TOTAL ASSESSMENT MARKS: 75	TIME ALLOWED: 3 HOURS

Notes:
It is allowing for student to use bearing table only and charts. 1/1
Systematic arrangement of calculations and clear neat drawings are essential.
Any data not given is to be assumed – Answer as many questions as you can. **Answer as brief. as possible.**

PROBLEM # ONE (25%)

I- A turbine running at 150 RPS has been designed with a rotor weighting 35kN and a 120 mm shaft diameter. What radial clearance and length/diameter ratio would you choose? An eccentricity ratio of 0.6 should not be exceeded. The oil is SAE 30. Inlet temperature is 50 C.

PROBLEM # TWO (25 %)

I- Why are cylindrical rolling bearings used? What magnitude of thrust load can they withstand?
II- Lest four types of bearings according to lubrication technique?
III- Lest 5 types of rolling bearings?
IV- What types of rolling bearings you should supported from four points (both inner and outer race should be supported from both sides)?
V- What kind of bearing you recommend for care wheel?

PROBLEM # THREE (60%)

An overhead crane wire wheel with diameter 50cm, it is required from you to choose type of bearings that can be used to support the wire wheel from inside (hub) on a stationary shaft. If the load carrying capacity of the crane is 10 tan so, determine the size of the bearing required. Not that the load could be tilted by an angle of 20°. Draw a detail drawing for the shaft, bearings, and the wire wheel hub showing your suggestion of bearing supports.