Hall Ticket No | | | | | | | | | | | Question Paper Code: **AME012**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B. Tech V Semester End Examinations (Regular), Dec – 2019

Regulations: IARE-R16

DESIGN OF MACHINE MEMBERS

(MECHANICAL ENGINEERING**)**

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

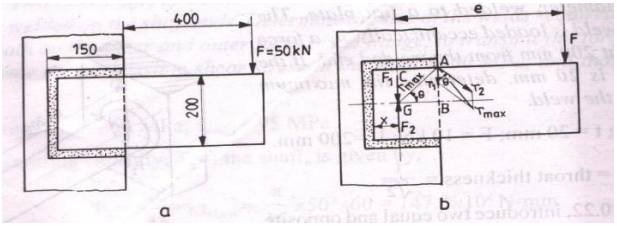
UNIT – I

1. a) Explain in detail about "Machine Design". List out various factors to be considered while designing a machine element. **[7M]**
   b) Determine the diameter of a ductile steel bar subjected to an axial tensile load of 40kN and a torsional moment of 16 x 105 N.mm. Use factor of safety of 1.5, E=2 x 105 MPa and Sy = 210 MPa. **[7M]**

2. a) What is meant by `stress concentration'? How do you take it into consideration in case of a component subjected to dynamic loading? **[7M]**
   b) A shaft is designed based on maximum energy of distortion as the criteria of failure and factor of safety of 2. The material used is 30C8 steel with S_y = 310 MPa. The shaft is subjected to an axial load of 40 kN. Determine the maximum torque that can be applied to the shaft before yielding. Diameter of shaft is 20 mm. **[7M]**

UNIT – II

3. a) What do you understand by the term welded joint? How it differs from riveted joint? **[7M]**
   b) Figure shows an eccentrically loaded welded joint. Determine the fillet weld size. Allowable shear stress in the weld is 80 MPa. **[7M]**



4. a) What do you understand by the term 'efficiency of a riveted joint'? According to I.B.R., What is the highest efficiency required of a riveted joint? **[7M]**
   b) Double riveted lap joint is made between 15mm thick plates. Rivet diameter and pitch are 25mm and 75mm respectively. If UTS are 400 MPa intention 320 MPa in shear & 630 MPa in crushing find minimum force for pitch which will replace the joint. If above joint is subjected to load such that factor of safety is 4 find out actual stresses developed in the plate and rivets. **[7M]**

UNIT – III

5. a) How are the keys classified? Draw neat sketches of different types of keys and state their applications. **[7M]**

   b) A 30 kW power is transmitted at 240 r.p.m, from 40 mm diameter shaft, by means of two kennedy keys of 12 x 12 mm cross-section. Determine the length of the keys. For the keys, take permissible shear stress as 60 MPa, and crushing stress as 90 MPa. **[7M]**

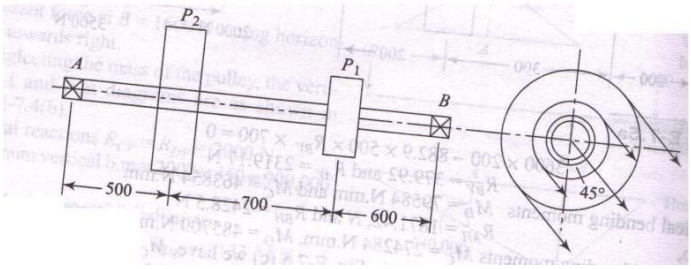
6. a) Describe the design procedure of a gib and cotter joint. What are the applications of a cotter joint? **[7M]**

   b) Design a knuckle joint to transmit 140 kN, with permissible stresses in tension; shear and compression are 75 Mpa; 60 Mpa and 150 Mpa respectively. **[7M]**

UNIT – IV

7. a) A 600 mm diameter pulley driven by a horizontal belt transmits power to a 200 mm diameter pinion. The pulley has a mass of 90 kg, $K_m = 2$, $K_t = 1.5$ and $\tau = 40$ MPa. Find the diameter of the shaft. **[7M]**

   b) Design a line shaft transmitting power to two machine tools. The power received by the shaft is 30 kW at 300 r.p.m. The power absorbed by pulley P_1 is 12 kW and the remaining power is absorbed by pulley P_2. The diameter of pulley P_1 is 300 mm and its mass is 40 kg. The diameter and mass of pulley P_2 are 600 mm and 75 kg respectively. Assume the belt tension ratio of 2 for both pulleys and the shaft material is 30C8 steel with $K_m = 2$ and $K_t = 1.5$. Draw the b.m and torque diagrams, assuming maximum shear stress theory. **[7M]**



8 a) Design a split muff coupling to transmit a power of 25 kW at 300 r.p.m. Use the same materials as in example. **[7M]**

   b) Design a bushed pin type of flexible coupling to connect the motor shaft and pump shaft of 50 mm and 40 mm diameter respectively when 15kW power is to be transmitted at 1200 r.p.m, the permissible bearing pressure for pin is 0.3 MPa. **[7M]**

UNIT – V

9 a) Classify springs according to their shapes. Draw neat sketches indicating in each case whether stresses are induced by bending or by torsion. **[7M]**

   b) A helical compression spring is subjected to a load varying between 800 and 1500 N. The material used is oil tempered cold drawn wire having Sys = 700 MPa and Ses = 356 MPa. Find the diameter of the wire and the number of coils if C=5 and N=2.5 **[7M]**

10 a) A load of 5 kN is dropped from a height of 50 mm axially on the spring of a wire of diameter 12 mm, spring index equal to 6 and the number of active coils as 8. Find the stress induced in the spring. **[7M]**

   b) A compression coil spring made of an alloy steel is having the following Specifications: **[7M]**
   Mean diameter of coil = 50 mm ; Wire diameter = 5 mm; Number of active coils = 20. If this spring is subjected to an axial load of 500 N ; calculate the maximum shear stress (neglect the curvature effect) to which the spring material is subjected.

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COURSE OBJECTIVES:

The course should enable the students:

I	Develop an ability to apply knowledge of mathematics, science, and engineering Outcomes
II	Knowledge of various design standards, safety, reliability, importance of dimensional parameters and manufacturing aspects in mechanical design.
III	Understanding the concepts of stresses, theories of failure and material science to analyze, design and/or select commonly used machine components.
IV	To develop an ability to identify, formulate, and solve various machine members problems

COURSE OUTCOMES (COs):

CO 1	Understanding design and analysis of load transmitting elements and selection of suitable materials and manufacture of these components.
CO 2	Analyzing the forces acting on various components and their design.
CO 3	Enhance the knowledge to applying the theories of failure and select optimum design size for various machine elements.
CO 4	Understanding need for joints and their application for different purposes in transmission of static loads.
CO 5	Ability to analyze and design all types of Springs for given application

COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

CLO Code	At the end of the course, the student will have the ability to
AME012.01	Understand various design variables and factors in the study of machine elements.
AME012.02	Explain the steps involved in design process, BIS Codes of Steels.
AME012.03	Understand the various Theories of failure, Design for Strength and rigidity.
AME012.04	Understand theories of failures, stress concentration and fluctuating stresses.
AME012.05	Explain estimation of endurance strength.
AME012.06	Ability to design lap and butt joints in riveted joints.
AME012.07	Explain design of welded joints, effects various stresses.
AME012.08	Explain the design procedure of various joints.
AME012.09	Understand the applications and comparison of various joints.
AME012.10	Explain bolts of uniform strength.
AME012.11	Understand various stresses in keys.
AME012.12	Ability to design procedure for keys.
AME012.13	Ability to design spigot and socket joint.
AME012.14	Understand Jib and Cotter joint and design procedure.
AME012.15	Ability to design knuckle joints.
AME012.16	Explain the design of shafts for complex loads.
AME012.17	Explain the design procedures of various shaft couplings.
AME012.18	Ability to design shafts for various types of loading.
AME012.19	Compare various shaft couplings and applications.
AME012.20	Ability to Design of various shaft couplings.
AME012.21	Understand of the basic features of springs.
AME012.22	Explain the design procedure for various springs.
AME012.23	Ability to design the various springs.
AME012.24	Compare applications of Extension springs.
AME012.25	Explain different types of end styles for helical compression and tension springs.

Mapping of Semester End Examinations to Course Learning Outcomes:

SEE Question No.		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	AME012.01	Understand various design variables and factors in the study of machine elements	CO 1	Understand
	b	AME012.02	Explain the steps involved in design press, BIS odes of Steels	CO 1	Understand
2	a	AME012.03	Understand theories of failures, stress concentration and fluctuating stresses.	CO 1	Understand
	b	AME012.04	Explain estimation of endurance strength.	CO 1	Remember
3	a	AME012.06	Compare various fasteners and their applications.	CO 2	Remember
	b	AME012.07	Ability to design lap and butt joints of riveted joints.	CO 2	Remember
4	a	AME012.08	Explain design of welded joints, effects various stresses.	CO 2	Understand
	b	AME012.10	Explain the design procedure of various joints.	CO 2	Remember
5	a	AME012.11	Understand various types of keys and joints	CO 3	Understand
	b	AME012.12	Understand the stresses indeed in various joints.	CO 3	Understand
6	a	AME012.13	Explain the applications of various joints.	CO 3	Remember
	b	AME012.15	Apply the design procedure for keys and otters.	CO 3	Understand
7	a	AME012.16	Explain the design of shafts for complex loads.	CO 4	Understand
	b	AME012.17	Explain the design procedures of various shaft couplings.	CO 4	Understand
8	a	AME012.18	Ability to design shafts for various types of loading.	CO 4	Understand
	b	AME012.19	Compare various shaft couplings and applications.	CO 4	Remember
9	a	AME012.20	Understand of the basic features of springs.	CO 5	Understand
	b	AME012.21	Explain the design procedure for various springs.	CO 5	Remember
10	a	AME012.22	Ability to design the various springs	CO 5	Understand
	b	AME012.23	Explain different types of end styles for helical compression and tension springs	CO 5	Understand

Signature of Course coordinator **HOD, Mechanical Engineering**