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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER -II

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

Regulations: IARE-R16

DESIGN OF MACHINE MEMBERS

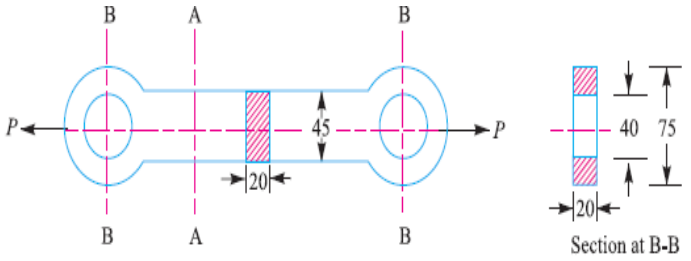
(MECHANICAL ENGINEERING**)**

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

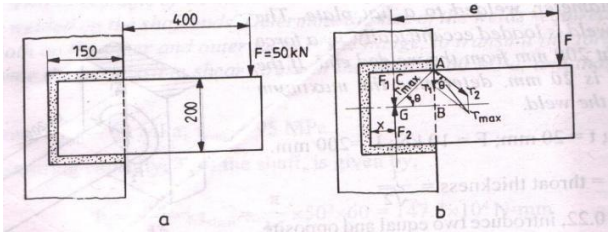
1. a) Define "Machine Design" and explain various stages with a flow chart **[7M]**
   b) A cast iron link, as shown in Fig. is required to transmit a steady tensile load of 45 kN. Find the tensile stress induced in the link material at sections A-A and B-B. **[7M]**



2. a) Define simple stress and give few examples of machine components subjected to simple stress. **[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]**

UNIT – II

3. a) Sketch any three basic types of welded joints. **[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 are the different series of threads and their applications? **[7M]**

b) A cast iron cylinder head is fastened to a cylinder of bore 500mm with 8 stud bolts. The maximum pressure inside the cylinder is 2 MPa. The stiffness of park kp=3kb. What should be the initial lightening load so that the joint is leak proof at maximum pressure? **[7M]**

UNIT – III

5. a) Classify the keys and state their applications. **[7M]**

b) A 45 mm diameter shaft is made of steel with yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2. **[7M]**

6. a) Describe the design procedure of knuckle joint. What are the applications of a knucke Joint? **[7M]**

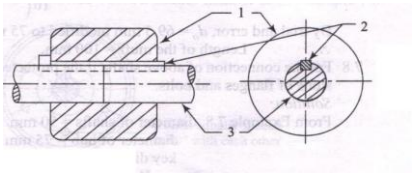
b) Design a knuckle joint to transmit 140 kN, with permissible stresses in tension; shear and compression are 75 Mpa; 60 Mpa and 150 Mpa respectively. **[7M]**

UNIT – IV

7. a) A gear is mounted centrally on a shaft of 0.25m length, between the supports. The pitch circle diameter of the gear is 0.15m. The gear transmits 10kW power at 240 r.p.m. assuming suitable stresses for the materials, determine **[7M]**
   i) shaft diameter,
   ii) Key dimensions and
   iii) Minimum width of the gear.

b) A shaft made of mild steel is required to transmit 100 kW at 300 r.p.m. The supported length of the shaft is 3 metres. It carries two pulleys each weighing 1500 N supported at a distance of 1 metre from the ends respectively. Assuming the safe value of stress, determine the diameter of the shaft. **[7M]**

8 a) Design a rigid muff coupling. Use C.I for the muff. The power transmitted is 25kW at 300 r.p.m. Sut = 200 MPa, F.S = 6, use 30C8 steel for the shaft consider Sy = 330 MPa and F.S = 4 **[7M]**



b) A marine type flange coupling is used to transmit 3.75 MW at 150 r.p.m. The allowable shear stress in the shaft and bolts may be taken as 50 MPa. Determine the shaft diameter and the diameter of the bolts. **[7M]**

UNIT – V

9 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 helical compression spring carries a fluctuating load varying from 428 N to 642 N. The spring index is 6 and factor of safety is 1.5. Sys = 648 MPa, Ses = 375 MPa. Calculate the spring wire diameter and the number of effective turns if deflection due to variation in load is 4mm. **[7M]**

10 a) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm2. Also calculate the maximum shear stress induced. **[7M]**

b) A close coiled helical compression spring of 12 active coils has a spring stiffness of k. It is cut into two springs having 5 and 7 turns. Determine the spring stiffnesses of resulting springs. **[7M]**

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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.
AME012.01	Explain the steps involved in design process, BIS Codes of Steels.
AME012.02	Understand the various Theories of failure, Design for Strength and rigidity.
AME012.03	Understand theories of failures, stress concentration and fluctuating stresses.
AME012.04	Explain estimation of endurance strength.
AME012.05	Ability to design lap and butt joints in riveted joints.
AME012.06	Explain design of welded joints, effects various stresses.
AME012.07	Explain the design procedure of various joints.
AME012.08	Understand the applications and comparison of various joints.
AME012.09	Explain bolts of uniform strength.
AME012.10	Understand various stresses in keys.
AME012.11	Ability to design procedure for keys.
AME012.12	Ability to design spigot and socket joint.
AME012.13	Understand Jib and Cotter joint and design procedure.
AME012.14	Ability to design knuckle joints.
AME012.15	Explain the design of shafts for complex loads.
AME012.16	Explain the design procedures of various shaft couplings.
AME012.17	Ability to design shafts for various types of loading.
AME012.18	Compare various shaft couplings and applications.
AME012.19	Ability to Design of various shaft couplings.
AME012.20	Understand of the basic features of springs.
AME012.21	Explain the design procedure for various springs.
AME012.22	Ability to design the various springs.
AME012.23	Compare applications of Extension springs.
AME012.24	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	CO1	Understand
	b	AME012.02	Explain the steps involved in design press, BIS odes of Steels	CO2	Understand
2	a	AME012.03	Understand theories of failures, stress concentration and fluctuating stresses.	CO2	Understand
	b	AME012.04	Explain estimation of endurance strength.	CO4	Remember
3	a	AME012.06	Ompare various fasteners and their applications.	CO6	Remember
	b	AME012.07	Ability to design lap and butt joints of riveted joints.	CO6	Remember
4	a	AME012.08	Explain design of welded joints, effects various stresses.	CO8	Understand
	b	AME012.10	Explain the design procedure of various joints.	CO10	Remember
5	a	AME012.11	Understand various types of keys and joints	CO11	Understand
	b	AME012.12	Understand the stresses indeed in various joints.	CO12	Understand
6	a	AME012.13	Explain the applications of various joints.	CO14	Remember
	b	AME012.15	Apply the design procedure for keys and otters.	CO16	Understand
7	a	AME012.16	Explain the design of shafts for complex loads.	CO17	Understand
	b	AME012.17	Explain the design procedures of various shaft couplings.	CO18	Understand
8	a	AME012.18	Ability to design shafts for various types of loading.	CO19	Understand
	b	AME012.19	Compare various shaft couplings and applications.	CO20	Remember
9	a	AME012.20	Understand of the basic features of springs.	CO21	Understand
	b	AME012.21	Explain the design procedure for various springs.	CO22	Remember
10	a	AME012.22	Ability to design the various springs	CO23	Understand
	b	AME012.23	Explain different types of end styles for helical compression and tension springs	CO25	Understand

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