SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR

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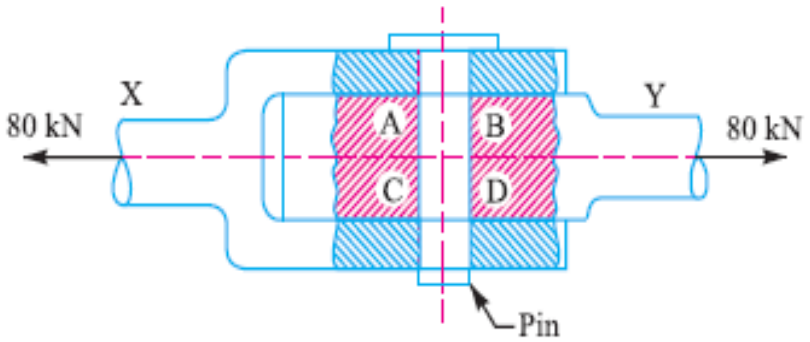
QUESTION BANK (Descriptive)

Subject with Code: DAM(16AG708) **Course & Branch:** B. Tech - AGE

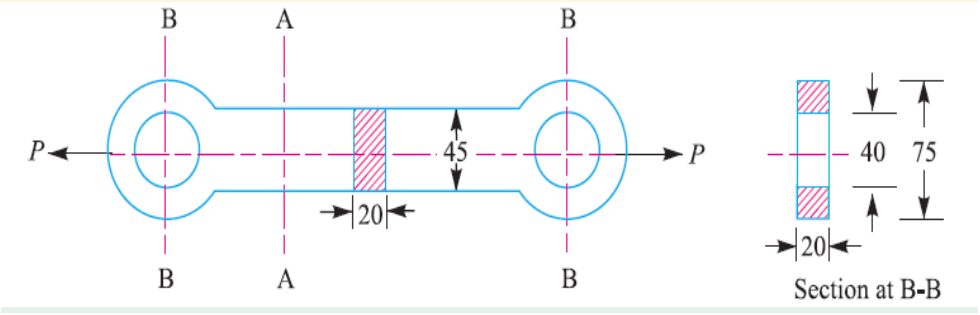
Year &Sem: III-B.Tech& I-Sem **Regulation:** R16

UNIT-1

1		What is machine design? How do you classify the machine design? Explain.	12M
2		What are the general design considerations should be followed while designing a machine element?	12M
3	(A)	Define laws of motion and derive expression for force.	6M
	(B)	A hydraulic pressure exerts a total load of 3.5 MN. This load is carried by two steel rods, supporting the upper head of the press. If the safe stress is 85 MPa and young's modulus E= 210 KN/mm^2, find 1) Diameter of the rods and 2) Extension in each rod in a length of 2.5m.	6M
4	(A)	Define stress and strain. Explain the types of stress and strain.	6M
	(B)	A pull of 80 KN is transmitted from a bar X to the bar Y through a pin as shown in fig. If the maximum permissible tensile stress in the bars is 100 MPa and the permissible shear stress in the pin is 80 MPa, find the diameter of bars and of the pin.	6M

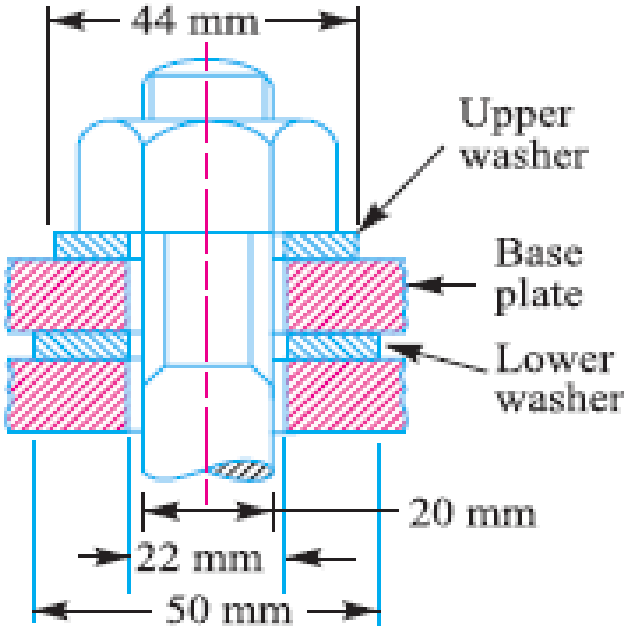


5	(A)	A cast iron link, as shown in Fig., is required to transmit a steady tensile load of 45 KN. Find the tensile stress induced in the link material at sections A-A and B-B.	6M



	(B)	A journal 25 mm in diameter supported in sliding bearings has a maximum end reaction of 2500 N. Assuming an allowable bearing pressure of 5 N/ mm^2, find the length of the sliding bearing.	4M
	(C)	Define load and types of load.	2M
6	(A)	What are the steps involved in designing a machine element?	8M
	(B)	Calculate the force required to punch a circular blank of 60 mm diameter in a plate of 5 mm thick. The ultimate shear stress of the plate is 350 N/mm^2.	4M
7	(A)	Explain briefly bearing stress.	6M
	(B)	A coil chain of a crane required to carry a maximum load of 50 KN as shown in figure. Find the diameter of the link stock, if the permissible tensile stress in the link material is not to exceed 75 MPa.	6M

8		A rectangular base plate is fixed at each of its four corners by a 20 mm diameter bolt and nut as shown in figure. The plate rests on washers of 22 mm internal diameter and 50 mm external diameter. Copper washers which are placed between the nut and the plate are of 22 mm internal diameter and 44 mm external diameter. If the base plate carried a load of 120 KN (including self weight, which is equally distributed on the four corners), Calculate the stress on the lower washers before the nuts are tightened. What could be the stress in the upper and lower washers, when the nuts are tightened to produce a tension of 5 KN on each bolt?	12M



9 (A) The piston rod of a steam engine is 50 mm in diameter and 600 mm long. The diameter of the piston is 400 mm and the maximum steam pressure is 0.9 N/mm^2. Find the compression of the piston rod if the young's modulus for the material of the piston rod is 20 KN/mm^2. 6M

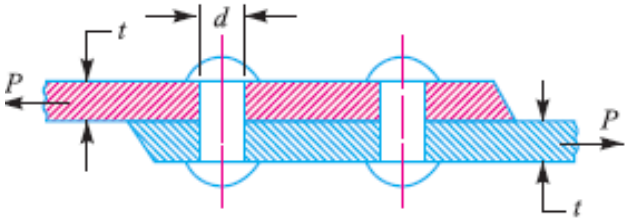
(B) A metallic rod 25 mm diameter is subjected to a tensile stress. The total extension measured over a length of 200 mm is 0.08 mm under a pull of 4000 kg. Calculate 6M

i) Stress
ii) Strain
iii) Modulus of elasticity for the material of the rod.

10 (A) Write the following 8M

i) Moment of force
ii) Couple
iii) Young's modulus
iv) Modulus of rigidity
v) Torque
vi) Mass moment of inertia

(B) Two plates 16 mm thick are joined by a double riveted lap joint as shown in figure. The rivets are 25 mm in diameter. Find the crushing stress induced between the plates and the rivet, if the maximum tensile load on the joint is 48 KN. 4M



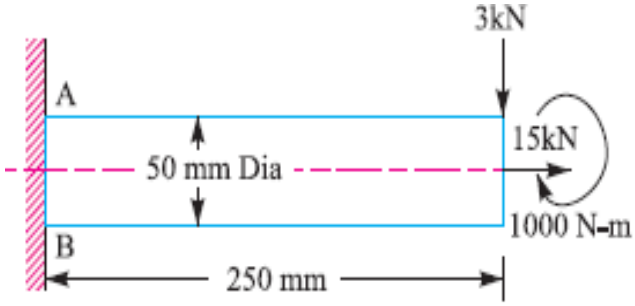
UNIT-2

1 Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. 12M

2 Design and draw a cotter joint to support a load varying from 30 KN in compression to 30 KN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 50 MPa; shear stress = 35 MPa and crushing stress = 90 MPa. 12M

3 What are the theories of failure under static load? Explain any two of them. 12M

4 A shaft, as shown in figure is subjected to a bending load of 3 KN, pure torque of 1000 N-m and an axial pulling force of 15 KN. Calculate the stresses at A and B. 12M



5 (A) Derive an expression for the impact stress induced due to a falling load. 8M

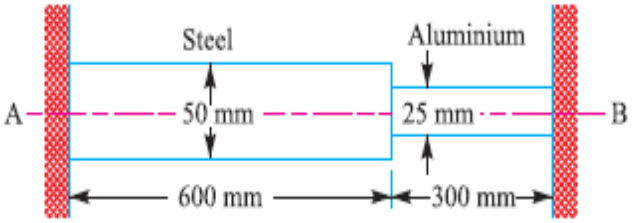
(B) A wrought iron bar 50 mm in diameter and 2.5 m long transmits shock energy of 100 N-m. Find the maximum instantaneous stress and elongation. Take young's modulus E = 200 GN/m^2. 4M

6 (A) Write about Resilience. 6M

(B) An unknown weight falls through 10 mm on a collar rigidity attached to the lower end of a vertical bar 3 m long and 600 mm^2 in section. If the maximum instantaneous extension is known to be 2 mm. What is the corresponding stress and the volume of unknown weight. Take E = 200KN/mm^2. 6M

7 (A) Design a Knuckle joint to transmit a load of 150 KN. The design stress may be taken as 75 MPa in tension, 60 MPa in shear, 150 MPa in crushing. 8M

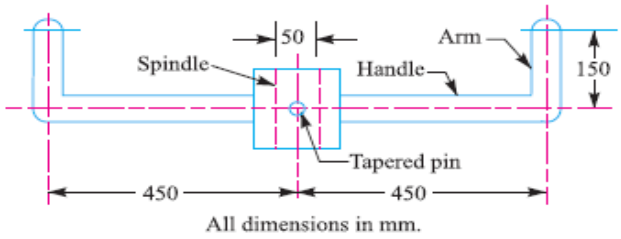
	(B)	What is linear strain and lateral strain?	4M
8		A composite bar made of aluminium and steel is held between the supports as shown in figure. The bars are stress free at a temperature of 37°C. What will be the stress in thetwo bars when the temperature is 20°C, if (a) the supports are unyielding; and (b) the supports yieldand come nearer to each other by 0.10 mm? It can be assumed that the change of temperature is uniform all along the length of the bar.Take E_s= 210 GPa, E_a = 74 GPa ;α_s = 11.7 × 10–6 / °C ; and α_a = 23.4 × 10–6 / °C.	12M



9		Explain stress – strain curve.	12M
10		Explain stresses in composite bars.	12M

UNIT-3

1		A foot lever is 1 m from the centre of shaft to the point of application of 800 N loads. Find: 1. Diameter of the shaft, 2. Dimensions of the key, and 3. Dimensions of rectangular arm of thefoot lever at 60 mm from the centre of shaft assuming width of the arm as 3 times thickness.The allowable tensile stress may be taken as 73 MPa and allowable shear stress as 70 MPa.	12M
2		A cranked lever, as shown in 15.10, has the following dimensions : Length of the handle = 300 mm Length of the lever arm = 400 mm Overhang of the journal = 100 mm If the lever is operated by a single person exerting a maximum force of 400 N at a distance of1/3 rd length of the handle from its free end, find : 1. Diameter of the handle, 2. Cross-section of thelever arm, and 3. Diameter of the journal.The permissible bending stress for the lever material may be taken as 50 MPa and shear stress for shaft material as 40 MPa.	12M
3		A handle for turning the spindle of a large valve is shown in figure. The length of the handle from the centre of the spindle is 450 mm. The handle is attached to the spindle by means of a round tapered pin. If an effort of 400 N is applied at the end of the handle, find: 1. mean diameter of the tapered pin, and 2. diameter of the handle.The allowable stresses for the handle and pin are 100 MPa in tension and 55 MPa in shear.	12M



All dimensions in mm.

4	(A)	Discuss briefly about cultivator.	6M
	(B)	Explain tractor drawn cultivator.	6M
5	(A)	Construct types of springs and explain briefly.	12M
6	(A)	Draw with neat sketch the springs in series and parallel.	4M
	(B)	Discuss briefly about Reaper.	8M
7	(A)	Explain Tractor mounted Boom Sprayer.	6M
	(B)	Calculate the time and power required for sowing four hectares of land by a 5 furrow seed drill, going 5 cm deep. The speed of the seed drill is 3 km/hr. and the pressure exerted by the soil on the seed drill is 0.42kg/cm^3. The spacing between the two furrow opener = 5 cm.	6M
8	(A)	Write the application of levers in engineering practice.	6M
	(B)	What are the different types of power threshers?	6M
9	(A)	What is the terminology connected with power thresher.	8M
	(B)	Write the installation of power thresher.	4M
10	(A)	What are the different methods of sowing crops?	8M
	(B)	A tractor is attached with a 9 tine cultivator. While feed testing, drawbar dynamometer shows an average pull of 14000 N. The speed of tractor is 6 Km/hr. Find the power of the tractor.	4M

UNIT-4

1	(A)	Derive an equation for design of shaft for axial load in addition to combine twisting and bending loads.	8M
	(B)	A line shaft rotating at 200 r.p.m. is to transmit 20 kW. The shaft may be assumed to be made of mild steel with an allowable shear stress of 42 MPa. Determine the diameter of the shaft, neglecting the bending moment on the shaft.	4M
2		Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used : Shear stress for shaft, bolt and key material = 40 MPa Crushing stress for bolt and key = 80 MPa Shear stress for cast iron = 8 MPa Draw a neat sketch of the coupling.	12M
3	(A)	Derive an equation for design of shaft for twisting moment.	6M
	(B)	Find the diameter of a solid steel shaft to transmit 20 kW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety	6M

as 8.
If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5.

4	(A)	Explain the types of keys with neat sketch.	6M
	(B)	A solid shaft is transmitting 1 MW at 240 r.p.m. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress as 60 MPa.	6M
5	(A)	Derive an equation for design of shaft for bending moment.	6M
	(B)	Design the rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key material are 42 MPa and 70 MPa. Take width of the key is 16 mm and thickness of the key 10 mm.	6M
6	(A)	Derive an equation for design of shaft for fluctuating loads.	4M
	(B)	A mild steel shaft transmits 20 kW at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearings 2.5 metres apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not to exceed 56 MPa. What size of the shaft will be required, if it is subjected to gradually applied loads?	8M
7	(A)	Derive an equation for design of shaft on the basis of rigidity.	6M
	(B)	A steel spindle transmits 4 kW at 800 r.p.m. The angular deflection should not exceed 0.25° per metre of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa, find the diameter of the spindle and the shear stress induced in the spindle.	6M
8		A hoisting drum 0.5 m in diameter is keyed to a shaft which is supported in two bearings and driven through a 12:1 reduction ratio by an electric motor. Determine the power of the driving motor, if the maximum load of 8 kN is hoisted at a speed of 50 m/min and the efficiency of the drive is 80%. Also determine the torque on the drum shaft and the speed of the motor in r.p.m. Determine also the diameter of the shaft made of machinery steel, the working stresses of which are 115 MPa in tension and 50 MPa in shear. The drive gear whose diameter is 450 mm is mounted at the end of the shaft such that it overhangs the nearest bearing by 150 mm. The combined shock and fatigue factors for bending and torsion may be taken as 2 and 1.5 respectively.	12M
9	(A)	A 15 kW, 960 r.p.m. motor has a mild steel shaft of 40 mm diameter and the extension being 75 mm. The permissible shear and crushing stresses for the mild steel key are 56 MPa and 112 MPa. Design the keyway in the motor shaft extension. Check the shear strength of the key against the normal strength of the shaft.	6M
	(B)	Derive strength of a sunk key.	6M
10	(A)	Write the design of flange coupling.	8M
	(B)	What are the functions acting on a sunk key? What is the effect of keyway cut into the shaft?	4M

UNIT-5

1		Explain fluctuation of energy.	12M
2		A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 percent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20 × 106 revolutions at 95 percent reliability, calculate dynamic load rating of the ball bearing.	12M
3	(A)	Discuss the various types of Sliding Contact Bearings.	6M
	(B)	Explain briefly hydrodynamic lubrication and its assumptions.	6M
4	(A)	What are the merits and demerits of Rolling Contact Bearings over Sliding Contact Bearings?	6M
	(B)	Explain classification of bearings.	6M
5	(A)	Draw neat sketch thurst ball bearings and explain briefly.	4M
	(B)	Discuss the various types of roller bearings.	8M
6	(A)	Derive an expression for energy stored in a flywheel.	6M
	(B)	What are the various types of Rolling Contact Bearings?	6M
7		Derive an equation for dynamic load rating for Rolling Contact Bearings under variable loads.	12M
8	(A)	Derive an expression for reliability of a bearing.	4M
	(B)	The rolling contact ball bearings are to be selected to support the overhung counter shaft. The shaft speed is 720r.p.m. The bearings are to have 99% reliability corresponding to a life of 24 000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability.	8M
9		The intercepted areas between the output torque curve and the mean resistance line of a turning moment diagram for a multi cylinder engine, taken in order from one end are as follows: – 35, + 410, – 285, + 325, – 335, + 260, – 365, + 285, – 260 mm^2. The diagram has been drawn to a scale of 1 mm = 70 N-m and 1 mm = 4.5°. The engine speed is 900 r.p.m. and the fluctuation in speed is not to exceed 2% of the mean speed. Find the mass and cross-section of the flywheel rim having 650 mm mean diameter. The density of the material of the flywheel may be taken as 7200 kg / m^3. The rim is rectangular with the width 2 times the thickness. Neglect effect of arms, etc.	12M
10		What are the various types of radial ball bearings?	12M