Model Question Paper

(2018 Scheme)

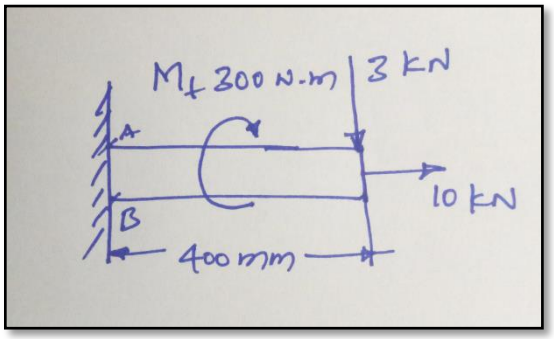
USN | | | | | | | | | | |

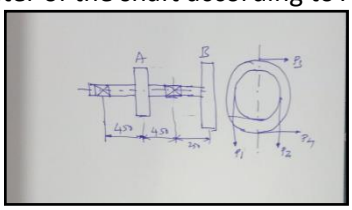
Fifth Semester B.E. Degree Examination

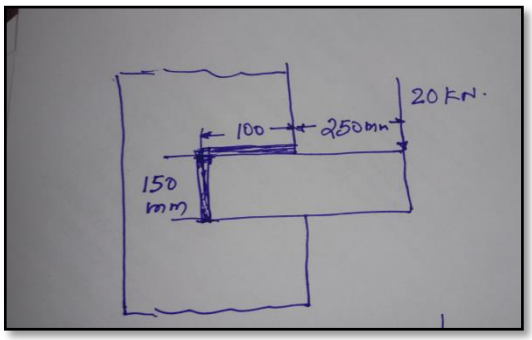
18IP52: Design of Machine Elements

TIME: 03 Hours **Max. Marks: 100**

Note: Answer any one full question from each

		Module – 1	Marks
Q.01	a)	Explain the maximum shear stress theory of failure.	**08**
	b)	A rod of 50 mm diameter is subjected to combined bending, axial and torsional loads determine the nature and magnitude stresses at critical points A &B  Figure: 1b	**12**
		OR	
Q.02	a)	What is stress concentration? Explain in brief.	**04**
	b)	A stepped shaft stepped down from50 mm diameter to 25 mm diameter with a fillet radius of 5mm is subjected to an axial pull of 10 KN determine the maximum stress induced taking stress concentration in to account.	**06**
	c)	A SAE 1025 rough finished water quenched steel rod is subjected to a completely reversed bending moment of 400 N-m. Determine the dia of the rod based on FOS of 2.5.	**10**
		Module – 2	
Q. 03	a)	Determine the maximum load for a simply supported beam of 50 mm diameter and 400 mm span, centrally loaded, as the load cyclically varies form W to 3W the endurence stress is 350N/mm2,ultimate stress is 700N/mm2.design the load for the FOS of 1.3.	**10**
	b)	A carbon steel shaft with ultimate stress of 600MPa, yield stress of 330 Mpa is subjected to a bending moment varying from 100 N-m to 200 N-m and torsional moment varying from 200 N-m and 400N-m. The maximum bending moment occuers at the same time as that of maximum torsional moment Determine the diameter of the shaft required for the FOS of 3.	**10**
		OR	

Q.04	a)	Derive soderberg equation and good man and design equations for fatigue loading	**10**
	b)	A hot rolled steel shaft is subjected to a torsional moment that varies from 330N-m clock wise to 110 N-m anti clock wise and an applied bending moment at a critical section varies from 400 to 300 N-m the shaft is of uniform cross secion the material of the shaft has ultimate strength of 550 Mpa and yield strength of 410Mpa .take size factor has 0.85 and surface finish factor has 0.62 and FOS 2. Determine the required shaft diameter.	**10**
		Module – 3	
Q. 05		A horizontal piece of commercial shafting is supported by two bearings 1.5 m apart.a keyed gear 20oinvolute and 175 mm in diameter is located 400 mm apart to the left of the right bearing driven by gear directly behind it.A600 mm diameter pulley is keyed to the shaft 600 mmto the right of the left bearing and drives axially with horizontal belt. The tension ratio of he belt is 3 to 1with slack side on top the drive transmits 45 KW at 330 rpm take Ks=Kt=1.5 .calculate the diameter of the shaft ,angular deflection take allowable shear stress 40MPa and G=80x109N/mm2	**20**
		OR	
Q. 06		A line of shaft supporting two pulleys A&B shown in fig 3b power is supplied to the shaft by means of a vertical belt on the pulley A, which is then transmitted to pulley B carrying a horizontal belt. The ratio of belt in tension side is 3:1.the limiting value of tension in belt is 2.7 KN the shaft is made of plain carbon steel 40C8 ultimate stress 650 N/mm2.the pullyes are keyed to the shaft .determine the diameter of the shaft according to ASME code if Kb=Kt=1.0  Figure: 6	**20**
		Module – 4	
Q. 07		Mention the modes of gear failure and derive the Lewis equation of gear tooth. Give the design procedural steps of design of spur gear	**20**
		OR	
Q. 08		Following are the details of pair of spur gears : Pinion Gear Rotaional Speed 1440 Rpm 720 Rpm Allowable Bending Stress 200 Mpa 200mpa Surface Hardness 250 Bhn 200 Bhn Modulus Of Ellastisity 200 Gpa 200 Gpa Tooth Profile 20 Degree Fdi System Center Distance 132mm, face width 32 mm, pinion has22 teeth Determine the power that can be transmitted based on a) Bending strength b) Surface endurance strength take error 0.02mm,what would be the endurance strength in bending of weaker one to have endurance strength 1.25 times the dynamic load.	**20**

Module – 5			
Q. 09	a)	A 16 mm thickness plate is welded to a vertical support by two fillet welds are shown in figure 9a.determine the size of the weld if the permissible stress for weld material is 75 Mpa  Figure: 9a	**10**
	b)	Design a double riveted butt joint to connect two plates 20 mm thickness the joint is zigzag riveted and has equal width cover plates. The allowable tensile stress for the plate is 100 Mpa and allowable shear and crushing stress are 60 Mpa and 120MPa respectively calculate the efficiency of joint should be leak proof.	**10**
OR			
Q. 10		Design a helical compression spring to sustain a compressive load that fluctuates between 1000N and 1800 N with an associated deflection of 25 mm. During the course of change in load the mean diameter of the spring may be taken as 8 times the spring wire diameter. The material selected has following properties shear stress in yield is 900N/mm2,endurance stress 800N/mm2,G=80900N/mm2 and FOS=2.25.	**20**

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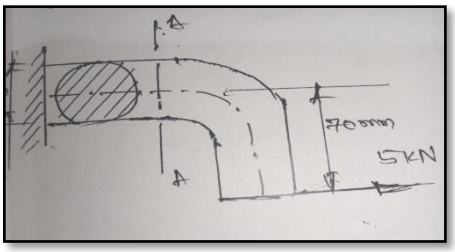
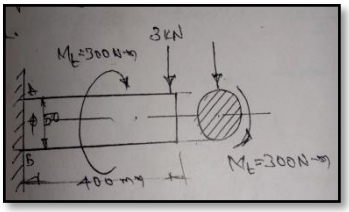
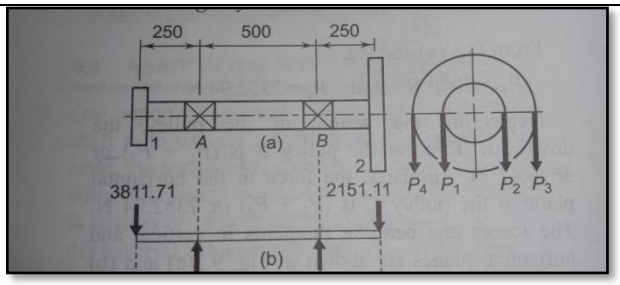
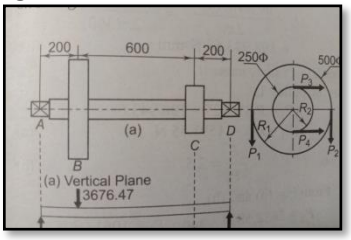
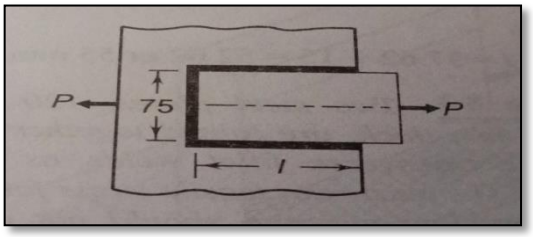
Module – 1	Marks

Q.01	a)	List and discuss the various considerations in design	**08**
	b)	What do you know about FOS? Explain. A steel bracket shown in figure 1a.is subjected to a load of 4KN.determine maximum stress induced at section A-A taking diameter as 30 mm.  Figure:1a	**12**
		OR	
Q.02	a)	List the theories of failure and discuss any one theories of failure in detail	**10**
	b)	Acircular rod of diameter 50mm shown in figure 2b is subjected to a point load of 3KN at its end and a torque of 300N-m.Determine the stresses induced in the rod.  Figure: 2b	**10**
		Module – 2	
Q. 03	a)	Derive an expression for Soderberg and Goodman equation for fatigue loading	**08**
	b)	A SAE1045 steel rod oil quenched ad drawn to 7000Ksubjected to axial load fluctuating between 1KN and 3KN. Determine the diameter of the rod required based on factor of safety of 2.	**12**
		OR	
Q.04	a)	what is Fatigue failure explain in brief	**06**
	b)	A SAE1045 oil quenched drawn to 700ok rough finished rod is subjected to a completely reversed axial loading of 2KN.Determine the dia of the rod based on FOS of 3. Use soderberg relation.	**14**
		Module – 3	
Q. 05		A layout of shaft carrying two pulleys 1 and 2 and supported on two bearings A&B as shown in figure.5a the shaft transmits 7.5 KW power at 360 rpm from pulley 1to pulley 2.the diameters of pulley 1 and 2 are 250 mm 500mm respectively. the masses of pulley 1and 2 are 10 kg and 30 kg. the belt tension acct vertically downward and ratio of belt tension on tight side to slack side for each pulley is 2.5:1.the shaft is made of plain carbon steel 40C8 with yield stress in tension as 380 N/mm2and FOS is 3.Estimate suitable diameter of the shaft. Permissible angle of twist is 0.5oper meter length calculate shaft diameter on the basis of torsional rigidity assuming G=79300Nmm2.	**20**

		 Figure: 5a	
OR			
Q. 06		The layout of transmission of shaft carrying two pulleys B and C and supported on bearing A&D belt is shown in figure 6a power is supplied to shaft by means of vertical belt on pulley B, which is then transmitted to the pulley C carrying horizontal belt. The maximum tension in the belt on the pulley B is 2.5 KN. The angle of wrap for both pulleys is 180oand coefficient of friction is 0.24.the shaft is made of plain carbon steel 30C8 with yield in tension 400N/mm^2 and FOS is 3. Determine shaft diameter on strength basis.  Figure: 6a	**20**
Module – 4			
Q. 07		A spur pinion of cast steel with allowable stress of 140 Mpa is to drive the spur gear of cast iron with allowable stress of 55MPa. The transmission ratio is 2 1/3:1. the diameter of the pinion is to be 105mm and 20 KW of power to be transmitted at 900 rpm of the pinion the teeth are to be 20 degree FDI form Design for the greatest no of teeth and determine necessary module and face width of gear for strength.	**20**
OR			
Q. 08		It is required to determine the proper proportions of a pair of spur teeth gear to transmit 27KW from a shaft running at 300 rpm to a parallel shaft with speed reduction of 3:1.the center to center distance of the shaft is to be near about 400mm.assuming that the pinion is made of forged steel, untreated 0.3% C and the gear is cast steel untreated with 0.2% C the teeth are 20o Stub tooth form. Assume normal service condition of 8hrs/day with steady load with carefully cut gears determine the pitch diameters, module no of teeth on gear face width check for dynamic and wear load.	**20**
Module – 5			
Q. 09	a)	Two flat plates subjected to tensile load P are connected together by means of double strap butt joint as in figure 9a the load is 250 KN and the width of the plate is w is 200mm the rivets and plates are made of same steel and permissible stress in tension, compression and shear are 70,100 and 60N/mm2respectively calculate : i)diameter of rivets ii)thickness of the plate iii)	**10**

		dimensions of the seame,namely.,p,p1,and m and iv) Efficiency of joint.	
	b)	A plate of 75 mm wide and 10 mm thick ,is joined together with another steel plate by means of single traverse and double parallael fillet welds as shown in figure 9b) the joint is subjected to a maximum tensile load of 55KN.the permissible tensile and shear stresses in weld material are 70 and 50 N/mm2 respectively. Determine the require length of teh parallel fillet weld.  Figure: 9b	**10**
		OR	
Q. 10	a)	Derive an expression for deflection of helical spring of circular cross section	**10**
	b)	Design a helical compression spring to sustain a deflection 22mm. The cross section of wire to be circular. Assume the elastic limit in shear as 800 N/mm2and rigidity modulus as 80900 N/mm2,FOS 2.5 and take C=6	**10**