		Register Number:	……..		
B.E DEGREE EXAMINATIONS: APRIL/MAY 2014					
(Regulation 2009)					
Fifth Semester					
MECHANICAL ENGINEERING					
MEC114**:** Design of Machine Elements					
Time: Three Hours			**Maximum Marks: 100**		
Answer all the Questions:-					
PART A (10 x 1 = 10 Marks)					
1.	The maximum bending stress, in a curved beam having symmetrical section, always occur, at the				
	(a)	Centroidal axis	(b)	Neutral axis	
	(c)	Inside fibre	(d)	Outside fibre	
2.	The eye bolts are used for				
	(a)	transmission of power	(b)	locking devices	
	(c)	lifting and transporting heavy machines	(d)	absorbing shocks and vibrations	
3.	Which of the following loading is considered for the design of axles?				
	(a)	Bending moment only	(b)	Twisting moment only	
	(c)	Combined bending moment and torsion	(d)	Combined action of bending moment, twisting moment and axial thrust	
4.	The taper on a rectangular sunk key is				
	(a)	1 in 16	(b)	1 in 32	
	(c)	1 in 48	(d)	1 in 100	
5.	The property of a bearing material which has the ability to accommodate small particles of dust, grit etc., without scoring the material of the journal, is called				
	(a)	bondability	(b)	embeddability	
	(c)	comformability	(d)	fatigue strength	
6.	Ball bearing are usually made from				
	(a)	Low carbon steel	(b)	High carbon steel	
	(c)	Medium carbon steel	(d)	High speed steel	
7.	In thrust bearing the load acts				
	(a)	along the axis of rotation	(b)	parallel axis of rotation	

	(c)	perpendicular to the axis of rotation	(d)	in any direction
8.	In transverse fillet welded joint, the size of weld is equal to			
	(a)	0.5 × Throat of weld	(b)	Throat of weld
	(c)	$2^{1/2}$ × Throat of weld	(d)	2 × Throat of weld
9.	When helical compression spring is cut into halves, the stiffness of the resulting spring will be			
	(a)	same	(b)	double
	(c)	one-half	(d)	one-fourth
10.	Due to the centrifugal force acting on the rim, the flywheel arms will be subjected to			
	(a)	tensile stress	(b)	compressive stress
	(c)	shear stress	(d)	All the above

PART B (10 x 2 = 20 Marks)

11.	How is stress concentration factor minimized by generalized design aspect?
12.	Write short notes on theories of failures and its application.
13.	Differentiate between keys and splines.
14.	A line shaft rotating at 200 rpm is to transmit 20 kW. It 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.
15.	What should be essential qualities of a rivet and its material?
16.	When will the weld deposit be weaker?
17.	State the type of stresses induced in a rim flywheel?
18.	What are active coils and inactive coils?
19.	What is Sommerfeld number? What importance it has in context of journal bearing design?
20.	What is known as self – lubricating bearing?

PART C (5 x 14 = 70 Marks)

21.	a	An element is acted upon by the following stresses. σ_x = 120 MPa , σ_y = 90 MPa, τ_{xy}= 30 MPa (i) Compute the stresses on a plane inclined at 20 degree. (ii) Find principal stresses and their location. (iii) Find maximum shear stress and its location.	
		(OR)	
	b	A cold drawn steel rod of circular cross-section is subjected to a variable bending moment of 565 Nm to 1130 N-m as the axial load varies from 4500 N to 13 500 N.	

		The maximum bending moment occurs at the same instant that the axial load is maximum. Determine the required diameter of the rod for a factor of safety 2. Neglect any stress concentration and column effect. Assume the following values: Ultimate strength = 550 MPa Yield strength = 470 MPa Size factor = 0.85 Surface finish factor = 0.89 Correction factors = 1.0 for bending = 0.7 for axial load The endurance limit in reversed bending may be taken as one-half the ultimate strength	
22.	a	A shaft is supported by two bearings placed 200 mm apart. A gear of 125 mm diameter is mounted at a distance of 100 mm to the right of left hand bearing and this transmits 3.7 kW at 120 rpm. Determine the suitable diameter for the solid shaft, allowing working stress is 42 N/mm^2 in shear for the material of the shaft.	
		(OR)	
	b	Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90kW at 50 rpm. The allowable shear stress in the shaft is 40MPa and the angle of twist is not to exceed 10 day in a length of 20 mm diameters. The allowable shear stress in the coupling bolt is 30MPa.	
23	a	Design a journal bearing for a centrifugal pump from the following data: Load on the journal=20000N, Speed of the journal=900rpm, Type of oil is SAEl0, for which the absolute viscosity at 55°C=0.017kg/m-s, Ambient temperature of oil = 15.5^{0}C, Maximum bearing pressure for the pump=1.5N/mm^2.Calculate also mass of the lubricating oil required for artificial cooling, If the rise of temperature, of oil be limited to l0^{o}C heat dissipation coefficient=1232W/m^2/^{o}C	
		OR	
	b	Select a single row deep groove ball bearing with the operating cycle listed below, which will have a life of 15 000 hours.	

Fraction of cycle	Type of load	Radial(N)	Thrust(N)	Speed (rpm)	Service factor
1/10	Heavy shocks	2000	1200	400	3.0
1/10	Light shocks	1500	1000	500	1.5
1/5	Moderate shocks	1000	1500	600	2.0
3/5	No shock	1200	2000	800	1.0

Assume radial and axial load factors to be 1.0 and 1.5 respectively and inner race rotates.

24.	a	Determine the size of the bolts and the thickness of the arm for the bracket as shown in Fig.1, if it carries a load of 40 kN at an angle of 60° to the vertical. The material of the bracket and the bolts is same for which the safe stresses can be assumed as 70, 50 and 105 MPa in tension, shear and compression respectively	

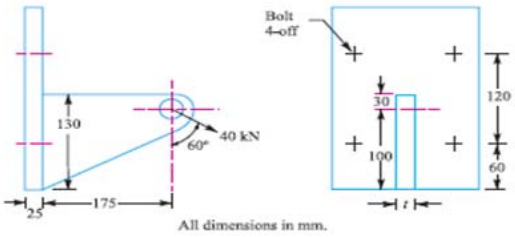

Fig.1

(OR)

	b	A bracket is welded to the side of a column and carries a vertical load *P*, as shown in Fig.2. Evaluate *P* so that the maximum shear stress in the 10 mm fillet welds is 80 MPa.	

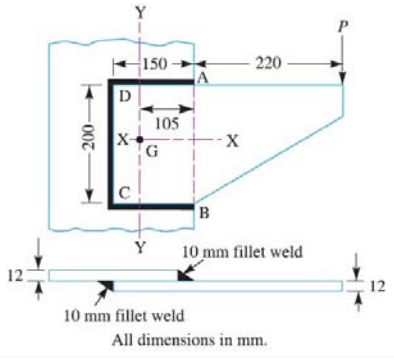

Fig.2

25.	a	A rail wagon of mass 20 tonnes is moving with a velocity of 2 m/s. It is brought to rest by two buffers with springs of 300 mm diameter. The maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa. Design the spring for the buffers.	

		(OR)	
	b	The turning moment diagram for a multi cylinder engine has been drawn to a scale of 1 mm = 1000 N-m and 1 mm = 6º. The areas above and below the mean turning moment line taken in order are 530, 330, 380, 470, 180, 360, 350 and 280 sq.mm. For the engine, find the diameter of the flywheel. The mean r.p.m is 150 and the total fluctuation of speed must not exceed 3.5% of the mean. Determine a suitable cross-sectional area of the rim of the flywheel, assuming the total energy of the flywheel to be that of the rim. The peripheral velocity of the flywheel is 15 m/s.	

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