**B.E. 2/4 (MECH) 1 SEM. MAIN EXAMINATION, NOV/DEC-2009**

**MECHANICS OF MATERIALS…………..**

***Answer all questions of Part A. answer five questions from Part B***

**PART-A**

1. **State and explain Hook’s law.**
2. **Explain the effect of change of temperature in a composite bar.**
3. **What do you understand by the term, point of contraflexuture ?**
4. **Describe the procedure for finding out the slope and defection of a cantilever beam of a composite section.**
5. **Define flexural rigidity and torsional rigidity.**
6. **Skectch the shear stress distribution in a circular shaft.**
7. **Write the significance of Mohr’s circle and its uses.**
8. **Distinguish between circumferential stress and longitudinal stress in a cylindrical shell when subjected to an internal pressure.**
9. **What do you mean by the terms column and strut? Distinguish clearly between columns and short columns.**
10. **Give the assumptions for determining the stresses in the bending of cured bars.**

**PART-B**

1. **A copper rod, 25 mm in diameter is encased in steel tube 30mm internal diameter and 35mm external diameter. The ends are rigidity attached. The composite bar is 500mm long and is subjected to an axial pull of 30kN. Find the stress induced in the rod and the tube. Take E for steel = 2\*10^5 N/mm^2 and E for copper = 1\*10^5 N/mm^2.**
2. **A horizontal beam, 30m long, carries a uniformly distributed load of 10kn/m over the whole length and a concentrated load of 30kN at the right end. If the beam is freely support at the left end, find the position of the second support so that the bending moment on the beam should be small as possible. Draw the diagrams of shearing force and bending moment and insert the principal values.**
3. **At a point in an elastic material under strain, there are normal stresses of 50 N/mm^2 and 30 N/mm^2, respectively at right angles to each other with a shearing stress of 25 N/mm^2. Find the principal stresses and the position of principal planes if**
4. **50 N/mm^2 is tensile and 30 N/mm^2 is also tensile**
5. **50 N/mm^2 is tensile and 30 N/mm^2 is compressive.**

**Find also the maximum shear stress and its plane in both the cases.**

1. **A 30cm\*16 cm rolled steel joint of I-section has flanges 11mm thick and web 8mm thick. Find the safe uniformly distributed load that this section will carry over a span of 5m if the permissible skin stress is limited to 120 N/mm^2.**
2. **Derive the expression for the deflection of a simply supported beam when subjected to a central point load by double integration method.**
3. **Compare the crippling loads given by Euler’s and Rankine’s formula for a tubular steel strut 2.3 m long having outer and inner diameter 38mm and 33mm respectively, loaded through pin joints at each end. Take the yield stress as 335N/mm^2. The Rankine’s constant = 1/7500 and E=0.205\*10^6 N/mm^2. For what length of strut of this cross-section does the Euler formula cease to apply?**
4. **A C.I. pipe has 20cm internal diameter and 50mm metal thickness, and carries water under a pressure of 5N/mm^2. Calculate the maximum and minimum intensities of circumferential stress and sketch the distribution of circumferential stress intensity and the intensity of radial pressure across the section.**

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**DYNAMICS OF MACHINES**

***Answer all questions of Part A. answer five questions from Part B***

**PART-A**

1. **Give examples of gyroscopic motion in daily life.**
2. **What is the effect of friction in governors?**
3. **Differentiate between engine flywheels and machine flywheels.**
4. **What is partial balancing of reciprocating parts? What is its effect?**
5. **How is balancing achieved in multi-cylinder engines?**
6. **Explain the whirling phenomenon in shafts.**
7. **Explain various conditions of daming in damped natural vibrations.**
8. **What is logarithmic decrement? Explain its use.**
9. **Why is Dunkerley’s method approximate?**
10. **What is the function of vibration isolator? Name various materials used for vibration isolation.**

**PART-B**

1. **A propeller shaft of an aero-engine is rotating at 2000 rpm. The distance between the bearings of the propeller shaft is 0.75m and the radius of gyration of propeller is 0.75m. Find the extra pressure on the bearings, when the aeroplane is whirling round in a horizontal circle of 300m radius at a speed of 300kmph. The weight of the propeller is 55kg.**
2. **A porter governor has all the four arms 300mm long. The upper arms are pivoted on the axis of rotation, while the lower arms are attached to the sleeve at a distance of 35mm from the axis of rotation. The mass of each ball is 7kg and the mass of the sleeve is 54kg. Calculate the equilibrium speed when the radius of rotation is 190mm.**
3. **A punching machine having a stroke of 10cm, punches 1.25cm hole once in every 10 seconds in a 1 cm thick steel plate. During punching operation, it does 600 Nm of work per square cm of shaded area. The maximum linear speed of the fly wheel rim is not to exceed 30m/s.**
4. **A rigid rotor has all its unbalance in one plane and can be considered to consist of three masses m1=5kg; m2=3kg at angle of 165’ c.c.w from m1 and m3=8kg at an angle of 85degrees c.w. from m1. The radii a1=20cm a2=8cm; a3=14cm; Determine the balancing mass at a radius of 10cm. Specify its location with respect to m1.**
5. **A mass of 100kg. is suspended on a spring having k=19600 N/m, and is acted up on by a harmonic force of 39.2N at the undamped natural frequency. The damping may be considered to be viscous with a coefficient of 98N.sec/m. determine (a) the damped natural frequency (b) amplitude of vibration of the mass. (c) the phase differences, between the force and the displacement.**
6. **In a three – rotor system, an engine drives a centrifugal pump through gears. The length of the shaft from engine flywheel to the gear is 1 meter with dia. 8cm and the length of the shaft from pinion to impeller is 40cm with dia. 6cm. The ratio of engine and pump speed is ⅓. Take moments of inertia of engine flywheel, gear wheel, pinion and pump impeller are 100, 11, 1.25 kg m^2 respectively. The modulus of rigidity of shaft material is 0.8\*10^11 N/m^2. Find the fundamental and the two mode frequencies of the free torsional oscillations.**
7. **Give short note on:**
   1. **Stability of governors.**
   2. **Function of governor and flywheel.**
   3. **Direct and Reserve crank method.**