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FACULTY OF ENGINEERING & TECHNOLOGY

M.E (Mechanical)Year Examination - June- 2015

Advanced Machine Design

(Revised)

[Time: Three Hours]

[Max. Marks:80]

“Please check whether you have got the right question paper.”

- i) Question no.1 from section A and question no 6 from section B are compulsory.
- ii) Solve any two questions from the remaining in each section.
- iii) Figure to right indicates full marks.
- iv) Assume suitable data if necessary.

SECTION-A

- Q.1 Attempt any two from the following 12
- a) State the characteristics and merits of Belleville spring and its applications.
 - b) Explain the construction of Mohr's circle diagram to find out principal stresses.
 - c) Define and explain the volumetric strain and bulk modulus
- Q.2 A loaded narrow gauge car of mass 1800 kg and moving at a velocity of 72 m/min is brought to rest by bumper consisting of two helical steel springs of square section. The min diameter of the coil is 6 times the side of the square section. In bringing the car to rest the springs are to be compressed 200 mm assuming the allowable shear stress as 365 MPa and spring index of 6, find 14
- a) Maximum load on each spring
 - b) Side of the square section of the wire
 - c) Mean diameter of the coils
 - d) Number of active coils take modulus of rigidity as 80KN/mm^2
- Q.3 A steel Belleville spring has the ratio $h/t = 1.5$ and the ratio of maximum diameter to minimum diameter is 2. The thickness of the disc is 6.25 mm. The stress induced in spring material is 1185 MPa when it is compressed flat. Find the load P and minimum and maximum radii. Find the possible stress the spring can sustain and corresponding load P. 14
- Q.4 Explain the Mohr's circle for triaxial state of stresses and strain. 14
- Q.5 Explain principal strain due to perpendicular stresses and shear stresses. 14
- SECTION-B**
- Q.6 Attempt any two from the following 12
- a) Explain design of gears through interactive programming
 - b) Explain philosophy of computer aided machine design
 - c) What is the effect of pressure angle in the cam design? What is undercutting of cam.
- Q.7 a) A 3.5 mm thick tension panel 11 cm wide containing an edge crack of 1 mm yielded at load of 105 KN. However at a load of 125 KN another panel of the same material cracked into tiny pieces. When the crack was 5.5 mm long with this information, calculate the yield stress and fracture toughness of the material. 08
- b) Explain hyperbolic sine creep law. Compare it with exponential creep law. 06

- Q.8 a) Explain creep in high temperature low cycle fatigue. 06
 b) A steel plate with a through thickness crack length $2a = 22\text{mm}$ is subjected to stress of 410 MPa normal to the crack. If the yield strength of the steel is 155 MPa , what is the plastic zone size and stress intensity factor for the crack? Assume that the plate is infinitely wide. 08
- Q.9 a) Write a note on selection of polynomials for cams 06
 b) Derive an expression for maximum pressure angle for a combination of radial cam and translating roller follower. 08
- Q.10 If the equation for polynomial cam is $y = c_0 + c_1x + c_2x^2 + c_3x^3 + c_4x^4 + c_5x^5$, the values of constants for the boundary conditions: 14
 When $x = 0$, $y = n$, $y' = 0$
 When $x = 1$, $y = y' = y'' = y''' = 0$
 Compute and plot values of y/h , y'/h , y''/h , y'''/h at intervals of $x = 0.3$