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Roll No:

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## **End** -Term Examination

Materials Selection and Design (MS-440)

## **Duration: 3 hrs**

Attempt all the following questions.

Q.1 Define the following: -

- a) Endurance limit (with diagram of metal and non-metal),
- b) Basic shaft and Basic Hole (with designations),
- c) Goodman's failure stress (with equation and diagram)
- d) Surface finish vs Texture
- e) Tolerance vs Fit

(2x5)

**Maximum Marks: 50** 

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Q.2 Define stress concentration and the factors responsible for it? What are the methods of reducing stress concentration? Find the maximum stress induced in a stepped circular shaft (Max diameter D = 50 mm) with fillet radius 'r'= 5 mm carrying a tensile load of 12 kN taking stress concentration into account? (Given  $K_t$ =1.64 for D/d = 2; Hint: Nominal stress = Load/Area) (3+2+5)

- Q.3 State the five principal theories of failure with its respective mathematical expressions for a member subjected to bi-axial stress?
  (2x5)
- Q.4 Draw the schematic and make complete fit analysis of 100 H11p7 (Basic size = 100 mm). The fundamental deviation for H and p are 0.00 mm and 0.037 mm respectively. ITG for 11 and 7 are 0.22 mm and 0.035 mm respectively.

Estimate the following: -

i.	Upper and lower limits for Hole in Hole basis system?	(2)
ii.	Upper and lower limits for Shaft in Shaft basis system?	(2)
iii.	Type of Fit?	(2)
iv.	Maximum metal limit for shaft and hole?	(1)
v.	Greatest and lowest possible amount of Allowance?	(1)
	and to west possible amount of Anowance?	(2)

**Q.5** Problem statement: In the construction of skyscrapers or tall buildings, cantilever beams are used as support structures for floors or overhangs that extend beyond the edge of the building's core. Select an appropriate material for a circular cross-section cantilever beam (length 'L', diameter 'd') loaded at its end (Load 'F') having high strength and light weight. (Hint:  $\sigma = \frac{FLd}{2I}$ ;  $I = \frac{\pi d^4}{64}$ ) The potential materials are Cast iron ( $\rho = 7.1g/cm^3$ ;  $\sigma_y = 300 MPa$ ), Al-alloy( $\rho = 2.77g/cm^3$ ;  $\sigma_y = 345 MPa$ ), Steel( $\rho = 7.85g/cm^3$ ;  $\sigma_y = 250 MPa$ ), PVC( $\rho = 1.3g/cm^3$ ;  $\sigma_y = 40.7 MPa$ ) and Mg alloy( $\rho = 1.77g/cm^3$ ;  $\sigma_y = 160 MPa$ ). Construct a Table showing the materials, important parameters and performance index?