Unit – V

9. (a) What do you understand by Optimization ? Discuss various optimization methods in brief 8

(b) A steel bar is subjected to 10 kN axial force. The allowable strength of the material is 80 N/mm^2. If the cost of material is ₹ 20/kg and the cost of machining per surface is ₹ 12, determine the section size for minimum cost of production. The length of bar is 780 mm. Take $\rho = 7500$ kg/m^3. 12

Or

10. (a) What is the use of Lagrange multipliers ? What is their practical significance ? 6

(b) Find the maxima and minima, if any, of the functions : 14

(i) $f(x) = 4x^3 - 18x^2 + 27x - 7$

(ii) $f(x) = x^4/(x-1)(x-3)^3$

Roll No. .....

ME–802

B. E. (Eighth Semester) EXAMINATION, June, 2012

(Mechanical Engg. Branch)

MACHINE DESIGN

(ME – 802)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt *five* questions in all selecting *one* question from each Unit. Assume suitable missing/misprint data, if any. Use of PSG Design Data/Mahadevan and Redd's design data book is permitted.

Unit – I

1. The following particulars refer to a belt drive from a cast iron pulley mounted on a shaft : 20

Power transmitted = 25 kW
R. P. M. of the shaft = 250
Ratio of belt tension = 3
Velocity of the leather belt = 800 m/mm
Allowable belt tension = 10 N/mm width
No. of arms with elliptical cross-section of the pulley = 6

Select a suitable belt and design (i) the pulley (ii) the shaft and (iii) the key. Safe stresses are as follows :
Shear stress for the shaft and key = 56 N/mm^2
Tensile stress for cast iron = 17 N/mm^2
Shear stress for cast iron = 14 N/mm^2

Or

2. (a) List the various types of ropes used in practice. How much factor of safety is generally recommended for fibre ropes ? 5

(b) An 8 × 19 (9/9/1) steel wire rope is used to lift a load of 15 kN from a depth of 1000 m. The maximum speed of rope is 2·5 m/sec. and acceleration is 1·5 m/sec.^{2} when starting under no slack condition. Determine the size of ropes required. 15

Unit–II

3. A gear drive is required to transmit 100 kW with driving pinion rotating at 1150 r. p. m. and driven gear having a velocity ratio of 5·25. The pinion and gear are made of same steel having σ_u = 700 MPa and σ_{sur} = 550 MPa. The sum of teeth on pinion and gear is to be 300. Assume total design load factor of 1·5, fatigue strength reduction factor of 2, factor of safety against surface failure and bending of 1·67 and 1·8 respectively, $\sigma/A = 0·8$. Calculate dimension of the gear. 20

Or

4. Design a pair of bevel gears for two shafts whose axes are at right angles. Speed of pinion shaft is 300 r. p. m. and that of gear shaft is 120 r. p. m. The power transmitted is 80 kW at gear shaft. 20

Unit–III

5. (a) What are the main functions of piston of an internal combustion engine ? Why are rings provided in a piston ? 8

(b) Determine the principal dimensions of cylinder for a vertical four stroke compression engine from the following data : 12

Brake power = 4·5 kW

Speed = 1200 r. p. m.

Indicated Mean Effective Pressure = 0·35 MPa

Mechanical Efficiency = 80%

Or

6. Design a piston for a four stroke diesel engine developing power at 1800 r. p. m. : 20

Cylinder bore	= 100 mm
Stroke length	= 120 mm
Maximum pressure	= 0·8 N/mm^2
b. s. f. c.	= 0·24 kg/kWh
L/r ratio	= 4
Heat conducted through the piston crown	= 10% of heat generated during combustion
C. V. of fuel	= 40 MJ/Kg

Assume piston is made of aluminium alloy.

Unit–IV

7. Design and draw a cast iron protected flange coupling t connect two shafts of 38 mm dia. transmitting 15 kW at 75 r. p. m. The overload capacity is 1·25 times the averag torque. The bolts and keys are made of C 20 steel an flanges are made of FG 250. 2

Or

8. (a) Differentiate between a th and thick pressure vessel.