**14ME702**

**Hall Ticket Number:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **IV/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION** | | | |
| **January, 2021** | **Mechanical Engineering** | | |
| **Seventh Semester** | **Design of Machine Elements-III** | | |
| **Time:** Three Hours | | **Maximum :** 60 Marks | |
| *Answer ALL Questions from PART-A.* | | | (1x12 = 12 Marks) |
| *Answer* ***ANY FOUR*** *questions from PART-B.* | | | (4x12=48 Marks) |
| **Part - A** | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 | Answer all questions | | | (1x12=12 Marks) | |
|  | a) | What is Wahl’s factor? State its importance in the design of helical springs. | | |  |
|  | b) | Define spring rate and spring index. | | |  |
|  | c) | Name the materials used for making leaves of multi-leaf spring? | | |  |
|  | d) | Why heat dissipation is necessary in clutches? | | |  |
|  | e) | Distinguish the clutch and the brake. | | |  |
|  | f) | What is a self-energizing brake? | | |  |
|  | g) | What is the function of flywheel? | | |  |
|  | h) | Define coefficient of fluctuation of energy | | |  |
|  | i) | List various types of stresses induced in flywheel rim. | | |  |
|  | j) | Name the materials used for I.C. engine piston. | | |  |
|  | k) | State the main advantage of overhung crankshaft. | | |  |
|  | l) | What do you mean by Multivariable Optimization? | | |  |
| **Part - B** | | | | | |
| 2 | a) | Classify springs according to their shape and explain type of stresses induced in each case. | | | 4M |
|  | b) | A railway wagon moving at a velocity of 1.5 m/s is brought to rest by a bumper consisting of two helical springs arranged in parallel. The mass of the wagon is 1500 kg. The springs are compressed by 150 mm in bringing the wagon to rest. The spring index can be taken as 6. The springs are made of oil hardened and tempered steel wire with ultimate tensile strength of 1250 N/mm2 and modulus of rigidity of 81370 N/mm2. The permissible shear stress for the spring wire can be taken as 50 % of the ultimate tensile strength. Design the spring and calculate: (i) wire diameter (ii) mean coil diameter (iii) number of active coils and (iv) total number of coils. | | | 8M |
|  | | | | | |
| 3 |  | A semi elliptical laminated vehicle spring to carry a load of 6000 N is to consist of seven leaves 65 mm wide, two of the leaves extending the full length of the spring. The spring is to be 1.1 m in length and attached to axle by two U-bolts 80 mm apart. The bolts hold the central portion of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts. Assume a design stress for spring material as 350 MPa. Determine i) thickness of leaves, ii) deflection of spring, iii) diameter of eye, iv) length of leaves and v) radius to which leaves should be initially bent. | | | 12M |
|  | | | | | |
| 4 |  | A single block brake with a torque capacity of 15 N-m is shown in the figure. The coefficient of friction is 0.3 and the maximum pressure on the brake lining is 1 N/mm2. The width of the block is equal to its length. Calculate (i) the actuating force P to be applied at the end of the lever for the clockwise and anti-clockwise rotation of brake drum (ii) the location of the pivot or fulcrum to make the brake self-locking for the clockwise rotation fulcrum (iii) the dimensions of the block. All dimensions are in mm. | **P.T.O.** | | 12M |
| **14ME702** | | | | | |
| 5 | a) | Name the different types of clutches. Give at least one practical application of each. | | | 4M |
|  | b) | A single plate clutch consists of one pair of contacting surfaces. The inner and outer diameters of the friction disk are 125 and 250 mm respectively. The coefficient of friction is 0.25 and the total axial force is 15 kN. Calculate the power transmitting capacity of the clutch at 500 rpm using i) uniform wear theory and ii) uniform pressure theory. | | | 8M |
|  | | | | | |
| 6 |  | The turning moment diagram of a multi-cylinder engine is drawn with a scale of 1mm=10 on abscissa and 1 mm= 250 N-m on the ordinate. The intercepted areas between the torque developed by the engine and mean resisting torque of the machine, taken in order from one end are -350, +800, -600, +900, -550, +450 and -650 mm2. The engine is running at a mean speed of 750 rpm and co-efficient of fluctuation of speed is 0.02. A rimmed flywheel made of Grey cast Iron mass density 7100 kg/m3 is provided. The spokes, hub and shaft are assumed to contribute 10% of the required moment of Inertia. The rim has rectangular cross section and ratio of width to thickness is 1.5.  Determine the dimensions of Rim | | | 12M |
|  | | | | | |
| 7 |  | Design and draw a cast iron flywheel used for a four stroke I.C. engine developing 180 kW at 240 rpm. The centrifugal stress developed in the flywheel is 5.2 MPa, the total fluctuation of speed is to be limited to 3% of the mean speed. The work done during power stroke is 1/3 more than the average work done during the whole cycle. The maximum torque on the shaft is twice the mean torque. The density of cast iron is 7220 kg/m3. | | | 12M |
|  | | | | | |
| 8 |  | Design a Cast Iron piston for single acting four stroke engine from the following data: Cylinder bore = 100 mm, Speed = 2000 rpm, stroke = 120 mm, Maximum gas pressure = 4 N/mm2, Indicated Mean effective pressure = 0.75 N/mm2, fuel consumption = 0.15 kg/brake power/hr, High calorific value of the fuel = 42x103 kJ/kg, Mechanical efficiency of the engine as 80%. Assume any other data required for the design. | | | 12M |
|  | | | | | |
| 9 | a) | What are the necessary and sufficient conditions for a multivariable optimization problem? Explain the significance of these conditions in optimization problem. | | | 6M |
|  | b) | Explain interval halving method and golden section method in brief? | | | 6M |

****