**18ME603**

**Hall Ticket Number:**

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| **III/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **July, 2021** | **Mechanical Engineering** | | |
| **Sixth Semester** | **Design of Machine Elements-II** | | |
| **Time:** Three Hours | | **Maximum: 5**0 Marks | |
| *Answer Question No. 1 Compulsorily.* | | | (10X1 = 10 Marks) |
| *Answer* ***ANY ONE*** *question from each Unit.* | | | (4X10=40 Marks) |

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| 1. | a) | State the functions of spring? | CO1 | |  |
|  | b) | What is meant by nipping of leaf spring? | CO1 | |  |
|  | c) | Why square threads are preferred over V-threads for power transmission? | CO2 | |  |
|  | d) | Define the term equivalent bearing load. | CO2 | |  |
|  | e) | State any four desirable properties of a good bearing material. | CO3 | |  |
|  | f) | Mention the advantages of V- belt drive over flat belt drive? | CO4 | |  |
|  | g) | What is a self-energizing brake? When a brake becomes self-locking? | CO4 | |  |
|  | h) | Why it is necessary to dissipate the heat generated when clutches operate? | CO4 | |  |
|  | i) | Define virtual number of teeth on helical gear. | CO4 | |  |
|  | j) | Define coefficient of fluctuation of speed and coefficient of steadiness. | CO4 | |  |
| **Unit - I** | | | | | |
| 2. | a) | Explain self-locking of a power screws. | CO4 | **3M** | |
|  | b) | Acme threads are used in a lead screw of a lathe, Acme threads have 50 mm outside diameter and 8 mm pitch. The axial pressure required from lead screw is 2500 N. The collar subjected to thrust in the carriage has 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 rpm. Take μ = 0.15 for screw and 0.12 for collar. Determine i) the power required to drive the lead screw and ii) The efficiency of the lead screw. | CO2 | **7M** | |
|  |  | **(OR)** |  |  | |
| 3. | a) | Explain the following terms of the spring:  i) Free length ii) Solid length iii) Active and inactive coils | CO1 | **3M** | |
|  | b) | A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 N/mm2 and modulus of rigidity 84 kN/mm2, find the axial load which the spring can carry and the deflection per active turn in case of i) Neglecting the effect of curvature and ii) Considering the effect of curvature. | CO2 | **7M** | |
| **Unit - II** | | | | | |
| 4. |  | Design a journal bearing for a centrifugal pump running at 1440 rpm. The diameter of the journal is 100 mm and load on each bearing is 20 kN. The bearing characteristic number may be taken as 28 for centrifugal pump bearings. The bearing is running at 75ᵒC temperature and the atmospheric temperature is 30ᵒC. The energy dissipation coefficient is 875 W/m2/ᵒC. Take diametral clearance as 0.1 mm. | CO3 | **10M** | |
|  |  | **(OR)** |  |  | |
| 5. | a) | What are rolling contact bearings? Discuss their advantages over sliding contact bearings. | CO3 | **3M** | |
|  | b) | A single row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The shaft rotates at 2000 rpm. The expected life L10h of the bearing is 20000 h. The minimum acceptable diameter of the shaft is 75 mm. Select a suitable ball bearing for this application. | CO3 | **7M** | |
| **Unit – III** | | | | | |
| 6. | a) | Derive the expression for the ratio of driving tensions for flat belt drive. | CO2 | **5M** | |
|  | b) | Design a rubber belt to drive a dynamo generating 20 kW at 2250 rpm and fitted with a pulley 200 mm diameter. Assume dynamo efficiency to be 85%. Take Allowable stress for belt = 2.1 MPa; Density of rubber = 1000 kg/m3; Angle of contact for dynamo pulley = 165° and coefficient of friction between belt and pulley = 0.3. | CO4 | **5M** | |
|  |  | **(OR)** |  |  | |
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| 7. | a) | Discuss different types of brakes giving atleast one practical application for each. | CO1 | **3M** | |
|  | b) | An automotive single plate clutch consists of two pairs of contacting surfaces. The outer diameter of the friction disk is 270 mm. The coefficient of friction is 0.3 and the maximum intensity of pressure is 0.3 N/mm2. The clutch is transmitting a torque of 530 N-m. Assuming uniform wear theory, calculate i) the inner diameter of the friction disk and ii) spring force required to keep the clutch engaged. | CO4 | **7M** | |
| **Unit - IV** | | | | | |
| 8. |  | Design a cast iron flywheel having six arms for a four-stroke engine developing 120 kW at 150 rpm. The mean diameter of the flywheel may be taken as 3 m. The fluctuation of speed is 2.5 % of mean speed. The work done during the working stroke is 1.3 times the average work done during the whole cycle. Assume allowable shear stress for the shaft and key as 40 MPa and tensile stress for cast iron as 20 MPa. The following proportions for the rim and elliptical arms may be taken: width of rim = 2 x thickness of rim; major axis = 2 x minor axis. | CO4 | **10M** | |
|  |  | **(OR)** |  |  | |
| 9. |  | It is required to design a pair of spur gears with 20ᵒ full depth involute teeth based on Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 kW, 1440 rpm motor. The starting torque of the motor is 150 % of the rated torque. The speed reduction is 4 : 1. The pinion as well as the gear is made of plain carbon steel 140C8 (σut = 600 N/mm2). The factor of safety can be taken as 1.5. Design the gears, specify their dimensions and suggest suitable surface hardness for the gears. | CO4 | **10M** | |

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