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| **Scheme of Valuation/Answer Key**(Scheme of evaluation (marks in brackets) and answers of problems/key) |
| **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018 |
| **Course Code: ME369** |
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| **Course Name: TRIBOLOGY** |

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| Max. Marks: 100 |  | Duration: 3 Hours |
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| **PART A**  |
|  |  | ***Answer any three full questions, each carries 10 marks.*** | Marks |
| 1 | a) | Historical development – 3; Industrial significant 2 | ( ) |
|  | b) | Definition of both conforming and nonconforming contact with examples – 2 | ( ) |
|  | c) | Definition with example 2+1 | ( ) |
| 2 | a) | Radial Axial (1+1) | ( ) |
|  | b) | Thin film , thick film and boundary |  |
|  | c) | Advantages:(a) Due to line contact between rollers and races, the radial load carrying capacity of the cylindrical roller bearing is very high.(b) Cylindrical roller bearing is more rigid than ball bearing.(c) The coefficient of friction is low and frictionalloss is less in high-speed applicationsDisadvantages1. In general, cylindrical roller bearing cannot take thrust load.

(b) Cylindrical roller bearing is not self-aligning. It cannot tolerate misalignment. It needs precise alignment between axes of the shaft and the bore of the housing.(c) Cylindrical roller bearing generates morenoise.  |  |
| 3 | a) | Laws – 1.5 exceptions 1.5 |  |
|  | b) | Adhesive component 2.5 , ploughing component 2.5 |  |
|  | c) | * *cleanliness,*
* *atmospheric dust and humidity,*
* *oxide and other films,*
* *surface finish,*
* *velocity of sliding,*
* *contact pressure,*
* *temperature and*
* *such things as grain size, direction of grain orientation, vibrations and static charges etc.*

Any two - 2 |  |
| 4 | a) | Pin on Disc, Pin on Flat, Four ball tester, Pin on cylinder etcListing 3 - 1.5 One method - 2.5 |  |
|  | b) | Explanation 2 graph 1 |  |
|  | c) | * Use of dissimilar materials
* Use of surface treatments such as carburizing, nitriding or some strong oxide film
* Thin layer with low shear strength
* High hardness of both surfaces (small *Ar)*
* High roughness
* Lubricant

(3) |  |
| **PART B**  |
| ***Answer any three full questions, each carries 10 marks.*** |
| 5 | a) | Adhesion (1),Abrasion (1),Fatigue (1),Tribochemical(1),Fretting(1),Erosive(1)  | ( ) |
|  | b) | Slideways in machine tool industryDraw dies in wire drawingCams and followersGearsDry or boundary- lubricated journal bearingsPiston rings / cylinder linersAny three - 3  | ( ) |
|  | c) | Any two factors 2  | ( ) |
| 6 | a) | Increased clearances between moving parts/machine elements• Unwanted freedom of movement resulting in loss ofprecision and performance deterioration• Increased vibration and loading• Shock loading• More rapid wear, seizure andFatigue failure |  |
|  | b) | Assumptions 2Contact occurs at a number of asperities, *n*• The asperities are spherical in shape• The contact areas are then circular with radius *a* and *Ar =* *a2*• Applied load supported by each asperity = *py**a2*( *py*is the yield pressure = hardness, *H* )• The sliding bodies are displaced by sliding distance = 2*a*• The wear particles are hemispherical in shapeDerivation 3  |  |
|  | c) | 2 applications 2 marks |  |
| 7 | a) | Viscoity 1., Newtons law of viscosity 2 |  |
|  | b) | Explanation 3 |  |
|  | c) | Figure 1 Mechanism 3 |  |
| 8 | a) | 2 factors - 2 marks |  |
|  | b) | 6 properties - 6 marks |  |
| **PART C**  |
| ***Answer any four full questions, each carries 10 marks.*** |
| 9 | a) | Adhesion 1 Adhesive coefficient of friction 2 | ( ) |
|  | b) | Definition 2 | ( ) |
|  | c) | Figure 2 , Explanation 3 | ( ) |
| 10 | a) |  4 points 4 marks1. Low starting and running friction except at very high speeds
2. Ability to withstand momentary shock loads
3. Accuracy of shaft alignment
4. Low cost of operation as no lubricant is required for service
5. Small overall dimensions
6. Reliability of service
7. Easy to mount and erect
8. Cleanliness
 | ( ) |
|  | b) | i) crankshaft bearings in petrol and diesel engines;(ii) centrifugal pumps;(iii) large size electric motors;(iv) steam and gas turbines;(v) concrete mixers, rope conveyors and marineinstallations Any four – 4 |  |
|  | c) | Any four – 4 |  |
| 11 | a) | Figure 1 explanation 1 |  |
|  | b) | * Roller Bearings are used in applications like Conveyer Belt Rollers.
* Roller Thrust Bearings are used to support thrust loads in car transmission between gears, in between housing and the rotating shafts, etc.
* Tapered roller bearings are used in car hubs, where they are usually mounted in pairs facing opposite directions so that they can handle thrust in both directions.
* Tapered roller bearing (TRB):

TRB can take both radial and axial loads and used for gear boxes for heavy trucks, bevel-gear transmission, lathe spindles, etcAny four – 4 |  |
|  | c) | Definition – 4 |  |
| 12 | a) | Thickness, 3D structure of the surface,surface unevenness, defects of the 3D structureAny 3 – 3 |  |
|  | b) | Figure 2 explanation 3 |  |
| 13 | a) | Definition 3  |  |
|  | b) | 3 advantages - 1.53 dis advantages – 1.5 |  |
|  | c | Induction hardening, flame hardening,laser hardening, electron beam hardening,chill casting and work hardening. |  |
| 14 | a) | Figure 3 Explanation 5 |  |
|  | b) | Diffusion chromising,Diffusion aluminising, slury / sinter formed ceramics, thermally spayed coatingsAny two 2 |  |
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