Register Number.....

M.E. DEGREE EXAMINATIONS: JANUARY 2009

First Semester

CAD / CAM

P07CC103 Integrated Mechanical Design

Time: Three hours **Maximum Marks: 100**

INSTRUCTIONS:-

1. Answer **ALL** questions:-
2. Any missing data may be suitably assumed.

PART A (20 x 1 = 20 Marks)

1. Adoptive design deals with
   A. improving the existing design B. following the existing design
   C. developing new design D. ergonomic design

2. Interchangeability can be achieved by
   A. standardization B. better process planning
   C. simplification D. better product planning

3. The terms of the series of preferred numbers in R20 series are doubled in every
   A. 2 terms B. 3 terms
   C. 6 terms D. 12 terms

4. According to B.I.S, the total number of tolerance grades is
   A. 8 B. 12 C. 16 D. 20

5. Torsional rigidity of a solid circular shaft of diameter,d is proportional to
   A. d B. d^2
   C. $1/d^2$ D. d^4

6. If 100kW power is to be transmitted at 100 r.p.m, by a shaft diameter, d; then for transmitting 100kW power at 800 r.p.m, the shaft diameter should be
   A.d/2 B.d/4
   C.d/8 D.8d

7. If two shafts of the same length ; one of which is hollow, transmit equal torques, and have equal maximum stress; then they should have equal
   A.polar moment of inertia B.polar modulus of section
   C.diameter D.angle of twist

8. A solid shaft of diameter, D carries a twisting moment, that develops shear stress, τ. If the shaft is replaced by a hollow one of outer diameter,D, and inner diameter, D/2; then the maximum shear stress will be

   A.1.067 τ B.1.143 τ C.1.333 τ D.2 τ

9. The difference between the tooth space and the tooth thickness as measured on the pitch circle, is called
A. working depth B. clearance C. tooth depth D. backlash

10. The contact ratio for gears is
A. zero B. less than one C. greater than one D. infinite

11. The bevel gears having straight teeth used for connecting non-parallel non-intersecting shafts are called
A. skew bevel gears B. hypoid gears
C. zerol bevel gears D. straight bevel gears

12. Worm gear drive is used for hoists because it is
A. very efficient B. noiseless
C. self-locking D.capable of taking large load

13. A jaw clutch is a
A. positive clutch B. friction clutch
C.centrifugal clutch D.cone clutch

14. The friction torque, with the assumption of uniform pressure, compared to uniform wear is
A.same B.greater
C.lower D.could be anything

15. The inner and outer radii of a single plate clutch is 100mm and 150mm respectively. It is subjected to an axial load of 1 kN. If the coefficient of friction is 0.5; according to uniform wear theory, the torque transmitted is
A.250 N-m B.125 N-m
C.62.5 N-m D.31.25N-m

16. A multi-disc clutch has three discs on the driving shaft (n1)and two discs on the driven shaft (n2).Number of pairs of contact surfaces is
A.2 B.3
C.4 D.5

17. Brakes convert
A.heat energy into kinetic energy B.kinetic/potential energy into heat energy
C.heat energy into potential energy D.kinetic energy into potential energy

18. The brake commonly used on locomotive bogies is
A. internal expanding brake B.band and block brake
C. shoe brake D.band brake

19. The type of brake used in motor cars is
A.block or shoe brake B.band brake
C.band and block brake D.internal expanding shoe brake

20. The temperature rise in the brake lining depends on
A.mass of the brake drum B. braking time
C.heat dissipation capacity of the brake lining D. all the above

PART – B (5 x 16 = 80 Marks)

21a. i. What is embodiment design? (2)

ii. Explain the phases of design with the aid of a block diagram. (7)

iii. Explain the concepts of integration in mechanical design. (7)

(OR)

21b. i. What do you mean by design standardization? (2)

ii. Explain the steps involved in standardization for design. (7)

iii. Considering a pump assembly, indicate the different types of fits used. (7)

22a. i. Distinguish design for strength and design for rigidity. (3)

ii. What is meant by endurance strength of a material? (3)

iii. A pulley is keyed to a shaft midway between two anti-friction bearings. The bending moment at the pulley varies from 170 N-m to 510 N-m and the torsional moment in the shaft varies from 55 N-m to 165 N-m. The frequency of the variation of the loads is the same as the shaft speed. The shaft is made of cold drawn steel having an ultimate strength of 540 MN/m^2 and yield strength of 400 MN/m^2. Determine the required diameter for an indefinite life. (10)

(OR)

22b. i. Sketch the spindle of a lathe and indicate the forces and constraints. (3)

ii. How are shafts manufactured? (3)

iii. A steel shaft is mounted on two bearings 500 mm apart and carries a bevel gear of 200 mm pitch diameter. At the pitch point of the gear, a tangential force 2.5 kN, a radial force 500 N and an axial load 750 N act. Determine the necessary diameter of the shaft. (10)

23a. i. What are the two important modes of failure in gears ? (3)

ii. What is virtual number of teeth in helical gears ? (3)

iii. Design a worm gear drive to transmit 25 kW at a worm speed of 1440 r.p.m. Velocity ratio is 20. An efficiency of atleast 80% is desired. The temperature rise should be restricted to 40^0C. Determine the required cooling area. (10).

(OR)

23b. i. What are the input parameters needed for the design of multispeed gearbox? (3)

ii. In a 12-speed gear box, which is the preferable structural formula? Explain. (3)

iii.Design the wheel shaft and select bearings for a helical gear speed reducer. Pinion torque = 103 Nm. Pinion speed = 475 rpm. Gear ratio = 4. Life of the drive is to be 36000 hrs. Pinion pitch circle diameter = 50.5 mm. Face width of the gears = 62.5 mm. Helix angle = 8.1 deg. Pressure angle = 20 deg. (in the normal plane). (10)

24a. i. Classify clutches based on the coupling methods. (3)

ii. Distinguish between a coupling and a clutch. (3)

iii. A single plate clutch, both sides being effective, is required to connect a machine shaft, which runs at 500 rpm. The moment of inertia of the rotating parts of the machine is 1kgm^2. The inner and outer radii of the friction discs are 50mm and 100mm respectively. Assuming uniform pressure of 0.1 N/mm^2 and coefficient of friction of 0.25, determine the time taken for the machine to reach full speed when the clutch is suddenly engaged. Also determine the power transmitted by the clutch, the energy dissipated during clutch slip and the energy supplied to the machine during engagement. (10)

(OR)

24b. i. What are the factors upon which the torque capacity a clutch depends? (3)

ii. Clutches are usually designed on the basis of uniform wear. Why? (3)

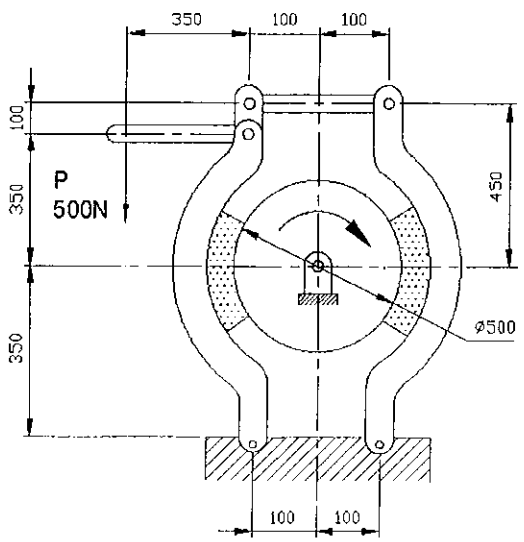
iii. Explain the working principles of centrifugal and overrunning clutches with the aid of sketches. (10)

25a. i. Classify the mechanical brakes. (3)

ii. What is a self-energizing brake ? (3)

iii. A double block brake is shown in Fig.1. Draw the free body diagram of forces for all the links. The brake drum rotates in a clockwise direction and actuating force is 500N. The coefficient of friction between the blocks and the drum is 0.35. Calculate the torque absorbing capacity of the brake. (10)

Fig : 1



(OR)

25 b. i. Mention two applications for shoe brakes. (3)

ii. What is the specific advantage of differential band brake over other types of band brakes? (3)

iii. The rope drum of an elevator hoist is 60 cm in diameter and the speed of the elevator is 180 m/min. The drive is fitted with a brake drum 90 cm diameter having four C.I brake shoes each subtending an arc of 45 deg. on the brake drum. This elevator weighs 18 kN loaded and the brake is to have sufficient capacity to stop the elevator in 3.6 m. Taking friction coefficient C.I on C.I as 0.2, determine

1. the radial pressure required on each shoe (6).
2. width of shoes if the allowable pressure on the brake shoe is 35 N/cm2 (2).
3. heat generated in stopping this elevator. (2).

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