

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

II SEMESTER M.TECH. (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, APR-MAY 2019

SUBJECT: ADVANCED POWER TRAINS [AAE 5231]

REVISED CREDIT SYSTEM (02/05/2019)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.
- 1A. Derive expressions for the maximum tractive effort, maximum acceleration and reactions at the wheels for a front wheel driven automobile, in terms of its constant parameters. (04)
- **1B.** Illustrate the mechanism of double de clutching. Which selective **(02)** transmission system warrants double de clutching?
- 1C. A centrifugal clutch has a driving member consisting of a spider having 4 shoes which are kept out of contact with the clutch case by springs until increase in centrifugal force overcomes the resistance of springs and power is transmitted by friction between shoes and the case. Find the mass and size of each shoe if 25 kW (04) is to be transmitted at 750 RPM with the engagement beginning at 75% of the running speed. Clutch case diameter= 300 mm, radial distance of gravity of each shoe from shaft axis= 125 mm, coefficient of friction between the friction surfaces=0.25.
- 2A. With a neat sketch, illustrate the constructional details and working of a torque converter during STALL and COUPLING modes. (03) Where does it find applications?
- 2B. What are hydrostatic drives? With a neat sketch, explain the working principle of an internal gear type positive displacement pump. (03)
- **2C.** The maximum gear ratio available in an automotive gear box is 4:1. Taking module of gears as 4.25 mm, find the size and number of teeth of gears of this 3- speed gear box. Calculate the face width

of constantly meshing gear (with the clutch shaft pinion) using **(04)** Lewis equation. The engine torque is 90 N-m. Value of Lewis form factor can be taken as 0.07 and allowable stress as 8800X10⁴ Pa for the constant mesh gear, upon which the design may be based. The clutch shaft pinion may have 15 teeth.

- 3A. An engine develops a torque of 105 N-m at 2500 RPM and drives through a gear box having constant mesh gears of 15 and 30 teeth respectively. The second gear wheel on the main shaft has 36 teeth and its meshing pinion has 18 teeth. The final drive is formed with a pinion carrying 8 teeth and a ring gear carrying 40 teeth. The wheel diameter is 840 mm. Transmission efficiency may be assumed as 85%. Find the following.
 - (i) Speed of the vehicle in second gear in kmph
 - (ii) Torque supplied to each half shaft in N-m.
- **3B.** Illustrate with relevant diagrams, how the speed synchronization (03) occurs in synchromesh gearboxes.
- **3C.** Show details of a gear shift valve and illustrate how the gear shifts are taking place in electronically controlled automatic transmission **(04)** systems.
- **4A.** The torque developed by an automotive engine is 82 N-m at 2000 RPM. The final drive ratio of the drive train is 4.7:1. In direct gear, the inside road wheel makes 100 RPM. Calculate the following.
 - (i) Speed of the crown wheel.

(03)

- (ii) Torque transmitted to the inner and outer driving road wheels.
- (iii) Power transmitted to the inner and outer driving road wheels.
- **4B.** Explain with a neat sketch and characteristics, constructional **(04)** details and working of a plate type centrifugal clutch.
- **4C.** Define critical speed of a shaft. Compare steel and composite propeller shafts based on their critical speeds with typical **(03)** characteristics shown graphically.
- **5A.** Discuss the constructional details of a full floating live rear axle with **(03)** a neat sketch. How the loads are shared in such an axle?
- 5B. An epicyclic gearbox has a fixed outer gear with 240 internal teeth. The planet gears have 20 teeth. The input is given to arm and the output is taken from central sun gear. Calculate the number of teeth on the driven sun gear and the gear ratio of the gear box.
- **5C.** What are the advantages of electric drives? Draw layout of an **(03)** electric propulsion system, clearly showing its subsystems.