NAME:_____
ID NO:_____

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BITS, PILANI – DUBAI CAMPUS
ME UC422 DYNAMICS OF MACHINES & VIBRATIONS
II SEMESTER 2006-2007

Q U I Z II (REGULAR)

Max. Marks: 10 **Duration: 30 Min.**
Date: 03-05-2007

- **Answer all questions.**
- **Put √ mark in the brackets provided against the suitable answer for the questions in PART I and fill in the blanks for the questions in PART II**
- **Marks are shown in brackets against each question.**

P A R T I

Question 1 The height of a Watt governor is **[1M]**

A directly proportional to the speed [ ]

B inversely proportional to the speed [ ]

C directly proportional to the square of the speed [ ]

D inversely proportional to the square of the speed [ ]

Question 2 Which of the following is spring-controlled governor? **[1M]**

A Porter governor [ ]

B Proell governor [ ]

C Watt governor [ ]

D Hartnell governor [ ]

Question 3 The balls are carried on the extension of lower arms in which of the following governor? **[1M]**

A Porter governor [ ]

B Proell governor [ ]

C Watt governor [ ]

D Hartnell governor [ ]

Question 4 **i)** A governor is said to be stable when for each speed there is only one radius of rotation.

ii) A governor is said to be isochronous if the equilibrium speed varies with the radius of rotation of balls. **[1M]**

A Both i) and ii) are true [ ]

B Both i) and ii) are false [ ]

C i) is true and ii) is false [ ]

D i) is false and ii) is true [ ]

Question 5 A single mass in a plane can not be balanced by a single mass in a different plane due to the following reason **[1M]**

A Resultant is a force [ ]

B Resultant is a couple [ ]

C Resultant is a force and a couple [ ]

D None of the above [ ]

Question 6 If a single mass can be balanced by two masses in different planes, then

i) centrifugal force on one balancing mass will be in the same direction and on another balancing mass will be opposite to that on the disturbing mass that of the disturbing mass

ii) centrifugal forces on both the balancing masses and disturbing mass will be in the same direction **[1M]**

A Both i) and ii) are true [ ]

B Both i) and ii) are false [ ]

C i) is true and ii) is false [ ]

D i) is false and ii) is true [ ]

PART II

Question 7 The change in vertical height of a governor when its speed increases from 60 rpm to 61 rpm is equal to _____ **[1M]**

Question 8 The single cylinder reciprocating engine has length of the stroke 320 mm and Speed of 120 rpm. If 50% of the reciprocating parts are to be balanced, the Resultant unbalanced force is_____ **[1M]**

Question 9 If two revolving masses 200 kg and 300 kg are attached perpendicular to each other at radii 270 mm and 300 mm respectively to a shaft rotating at a speed of 150 rpm, the balancing force at a radius of rotation 200 mm is_____ **[1M]**

Question 10 The ratio of the maximum value of primary and secondary forces for a Reciprocating engine mechanism is_____ **[1M]**

BITS, PILANI – DUBAI CAMPUS
III Year MECH
ME UC422 DYNAMICS OF MACHINES & VIBRATIONS
II SEMESTER 2006-2007

Comprehensive Examination (Closed Book)

Max. Marks: 40 **Duration: 3 Hrs.**
Date: 28-05-2007

- **Answer all questions.**
- **Marks are shown in brackets against each question.**
- **Draw suitable sketches, wherever necessary.**

Question 1

(a) The length of the connecting rod of a vertical double acting steam engine is 1.6m. The diameter of cylinder is 420 mm and stroke of the engine is 600 mm. The crank is rotating at 200 rpm in the clock-wise direction. The crank has turned through 35^0 from the top dead centre and piston is moving downwards. The steam pressure above and below the piston are 0.6 N/mm^2 and 0.06N/mm^2 respectively. The mass of the reciprocating parts is 220 kg and the diameter of piston rod is 40 mm. Fin the Piston effort and crankpin effort. **[6M]**

(b) The connecting rod of length between the two centres is 500 mm has a mass of 15 kg and the distance of its centre of gravity from the big end is 200 mm. The radius of gyration of the connecting rod is 140 mm about an axis through centre of gravity. If the connecting rod is replaced by two masses located at the two centres, find the masses and correction couple that must be applied for complete dynamical equivalence of the system, when the angular acceleration of the connecting rod is 150 rad/s^2 clock-wise. **[4M]**

Question 2

(a) The turning moment diagram of for a multi-cylinder engine has been drawn to a vertical scale of 1mm = 325 Nm and a horizontal scale of 1 mm = 4.5^0. The areas above and below the mean torque line are -30, +382, -262, +312, -302, +244, -380, +267 and -231 mm^2. The fluctuation of speed is limited to 1.8% of mean speed which is 300 rpm. Determine a suitable diameter and cross-section of the fly wheel rim for a limiting value of the safe centrifugal stress of 6 N/mm^2. The density of the rim material may be assumed as 7000 kg/m^3. The width of the rim is 4.5 times its thickness. Neglect the effect of the boss and arms. **[8M]**

(b) Explain briefly various types of centrifugal type of governor mechanisms. **[2M]**

Question 3

(a) A single cylinder reciprocating engine has the following data:
Length of the connecting rod: 800 mm ; speed: 120 rpm ; stroke: 320mm;
Mass of reciprocating parts: 45 kg; mass of revolving parts: 35 kg.
If 60% of reciprocating parts and all the revolving parts are to be balanced, then find

(i) balancing mass at a radius of 300 mm
(ii) resultant unbalanced force when the crank is rotated 60^0 from TDC and
(iii) primary and secondary forces. **[5M]**

(b) A ship has a turbine rotor of mass 5 tonnes and radius of gyration 600 mm. It rotates at 1500 rpm in clock-wise sense when looking from the stern. Determine the gyroscopic couple under the following conditions:

(i) The ship steers to the left at a radius of 100 m with a speed of 2 km/hr.
(ii) The ship pitches with SHM with amplitude of 8 degrees and time periods 12 sec. **[5M]**

Question 4

(a) Derive an expression used for finding critical speed of the shaft and find the critical speed of a simply supported shaft which is of 20 mm diameter and of length 6m. The shaft carries a load of 10 N at its centre. Take Young's modulus of the material of the shaft is 200 GN/m^2. **[5M]**

(b) Explain briefly logarithmic decrement and determine logarithmic decrement for a vibrating system, which consists of mass of 3.5 kg, a spring of stiffness 2.5 N/mm and damper of damping coefficient 0.018 N/mm/s. **[5M]**

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BITS, PILANI – DUBAI CAMPUS
ME UC422 DYNAMICS OF MACHINES & VIBRATIONS
II SEMESTER 2006-2007

Q U I Z I (REGULAR)

Max. Marks: 10

Duration: 30 Min.
Date: 29-03-2007

- Answer all questions.
- Put √ mark in the brackets provided against the suitable answer.
- Marks are shown in brackets against each question.

Question 1 Which of the following is considered as a dynamically equivalent system for finding the actual torque on crank shaft? [1M]

A Piston [ ]

B Crank shaft [ ]

C Connecting rod [ ]

D Cylinder [ ]

Question 2 Thrust on the cylinder walls is [1M]

A Parallel to the line of stroke. [ ]

B Perpendicular to the line of stroke. [ ]

C Parallel to the connecting rod. [ ]

D Parallel to the crank shaft. [ ]

Question 3 For a dynamically equivalent rigid body, its radius of gyration about the centroidal axis is [1M]

A Geometric mean of the distances of two masses from the centre of gravity. [ ]

B Harmonic mean of the distances of two masses from the centre of gravity. [ ]

C Arithmetic mean of the distances of two masses from the centre of gravity. [ ]

D Mean of the radii of gyration of two masses. [ ]

Question 4 Which of the following is not the condition for a dynamically equivalent Sysem? **[1M]**

A Mass of the rigid body is equal to the sum of the two masses at its ends. [ ]

B The moments of the two masses about the centre of gravity of rigid body must be equal. [ ]

C The radii of gyration of rigid body about its centre of gravity must be equal to the sum of radii of gyration of two masses. [ ]

D The moment of inertia of the rigid body about its centre of gravity must be equal to the sum of moments of inertia of the two masses. [ ]

Question 5 Piston effort for a horizontal engine depends on the following forces **[1M]**

A Force on piston, inertia force and gravity weight. [ ]

B Force on piston and inertia force. [ ]

C Force on piston only. [ ]

D Ineria force only. [ ]

Question 6 The net force on the piston due to a gas pressure of 750 kN/m^2 the cylinder of 150 mm diameter is equal to **[1M]**

A 13.35 kN [ ]

B 13.45 kN [ ]

C 13.55 kN [ ]

D 13.25 kN [ ]

Question 7 The connecting rod has a radius of gyration about it centroidal axis is 625 mm. The equivalent length of connecting rod if one of the masses is at a distance of 1 m from its centre of gravity is **[1M]**

A 1.39 m [ ]

B 1.29 m [ ]

C 1.49 m [ ]

D 1.19 m [ ]

Question 8 The length of the stroke of an engine is 600 mm. If the crank pin effort is 19 kN, then the approximate on the crank shaft is **[1M]**

A 5.7 kNm [ ]

B 5.3 kNm [ ]

C 5.2 kNm [ ]

D 5.5 kNm [ ]

Question 9 The angle and radius of crank shaft are 30^0 and 100 mm respectively. if the correcting force at the crank pin is 90 N, then correcting torque on the crank shaft is **[1M]**

A 7.9 Nm [ ]

B 7.7 Nm [ ]

C 7.6 Nm [ ]

D 7.8 Nm [ ]

Question 10 If the angle of connecting rod and piston effort are 8^0 and 30 kN respectively, the force on connecting rod is equal to **[1M]**

A 30.35 kN [ ]

B 30.30 kN [ ]

C 30.25 kN. [ ]

D 30.20 kN [ ]

BITS, PILANI – DUBAI CAMPUS
DYNAMICS OF MACHINES & VIBRATIONS
II SEMESTER 2006-2007

T E S T I (REGULAR)

Max. Marks: 20 | Duration: 50 Min.
Date: 04-03-2007

- Answer all questions.
- Assume any missing data.
- Marks are shown in brackets against each question.

Question 1

a. Distinguish between a machine and structure. [2M]
b. Mention various types of kinematic pairs. [2M]
c. Explain briefly the difference between machine and mechanism. [2M]
d. State D-Alembert's principle of motion [2M]

Question 2

A link, shown in the **figure 1** turns at an angle of 35^0 to the horizontal about a fixed pivot with an angular velocity of 4 rad/s(clock-wise) and an angular acceleration of 5 rad/s^2 (counter clock-wise). A particle moves along the link and at a certain instant, it is at a radius of 2m, with an outward velocity of 3m/s and an inward acceleration of 4 m/s^2. Determine the magnitude and direction of the total velocity and acceleration of the particle, relative to the pivot. [4M]

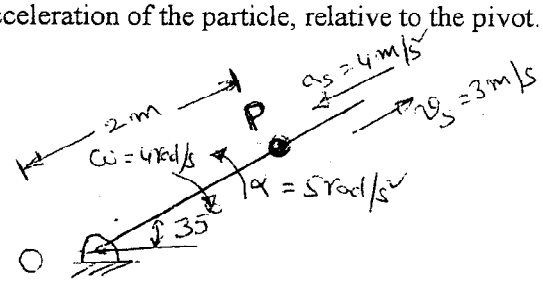

figure 1

Question 3

For the four bar chain, shown in the **figure 2**, determine the inertia force at the point E if the mass of coupler BC is 5 kg. [8M]

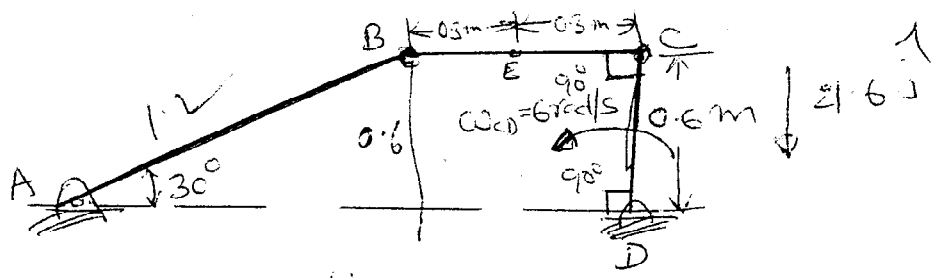

figure 2