CBCS SCHEME

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17ME71

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Energy Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain the principle of over feed stokes with neat diagram. **(10 Marks)**

b. Explain Hydraulic ash handling process, with a neat sketch. **(10 Marks)**

OR

2 a. A chimney is 28m height and temperature of hot gases inside is 320^0C. The temperature of outside air is 23^0C and furnace is supplied with 15kg of air per kg of coal burnt. Calculate i) Draught in mm of water ii) Draught head in meters of hot gases. **(10 Marks)**

b. Explain the central or bin system of burning pulverised coal. **(10 Marks)**

Module-2

3 a. With a neat diagram, explain the general layout of diesel power plant. **(10 Marks)**

b. Explain the general layout of hydroelectric power plant, with a neat diagram. **(10 Marks)**

OR

4 a. Classify the hydroelectric power plants on the basis of head. Explain each type of plant in detail. **(10 Marks)**

b. With a neat diagram, explain Pump Fuel injection system. **(10 Marks)**

Module-3

5 a. Explain Pyranometer with neat sketch to measure beam and diffused radiations. **(10 Marks)**

b. With a neat diagram, explain typical solar flat plate collector. **(10 Marks)**

OR

6 a. What are the main advantages of solar – cell? Explain the conversion of solar energy to electricity through photovoltaic cell. **(10 Marks)**

b. Explain Phase change (Latent heat) heat storage concept. Explain the properties of materials used in latent heat storage. Comment on Latent heat storage materials. **(10 Marks)**

Module-4

7 a. Derive an expression for the power of wind mill with condition. **(10 Marks)**

b. With neat diagram, explain Single basin storage Tidal Power Plant and also comment on the advantages of Tidal Power Plant (Tidal). **(10 Marks)**

OR

8 a. Explain the typical horizontal axis wind mill, with a neat sketch. **(10 Marks)**

b. What are the different resources that can be used as Biomass for biogas generation? **(10 Marks)**

Module-5

9 a. Describe the photosynthesis process with relevant chemical reactions. Also explain the importance of photosynthesis in biofuel generation. **(10 Marks)**

b. Explain closed Rankine cycle OTEC system with neat sketch. **(10 Marks)**

OR

10 a. Explain with a neat sketch, the water dominated Geothermal system. **(10 Marks)**

b. What is the work of fuel cell? Explain typical H_2O_2 fuel cell with a neat sketch. **(10 Marks)**

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17ME72

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Fluid Power Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. What are the various applications of fluid power systems? **(05 Marks)**

b. State Pascal's law and mention the various advantages of fluid power systems. **(05 Marks)**

c. Explain the various components used in hydraulic systems and its symbol. **(10 Marks)**

OR

2 a. Describe the various functions of hydraulic fluids and its types. **(05 Marks)**

b. Define the fluid properties such as viscosity, viscosity index, pour point, fire point, flash point. **(05 Marks)**

c. Explain the working of return line and suction line filtering with the aid of sketches. **(10 Marks)**

Module-2

3 a. What are the various types of positive displacement pump used in fluid power system? **(05 Marks)**

b. Explain with a sketch the construction and working of bladder type accumulator used in fluid power system. **(05 Marks)**

c. Explain the construction and working of external gear pump with a neat sketch. **(10 Marks)**

OR

4 a. Explain the construction and working of double acting cylinder with a neat sketch. **(05 Marks)**

b. An 8 cm diameter hydraulic cylinder has a 4 cm diameter rod. If the cylinder receives flow at 100 LPM and 12 MPa. Find the

(i) Extension and retraction speeds.

(ii) Extension and retraction load carrying. **(05 Marks)**

c. Explain the construction and working of a hydraulic cylinder cushioning with a neat sketch. Also draw symbol. **(10 Marks)**

Module-3

5 a. List various types of control valves. **(03 Marks)**

b. With a neat sketch explain the working of pressure relief valve. **(07 Marks)**

c. Explain the hydraulic regenerative circuit with a neat sketch. **(10 Marks)**

OR

6 a. With a neat sketch, explain the working of ball type check valve. **(05 Marks)**

b. With a neat sketch, explain the working of the 4/2 manually operated direction control valve. **(05 Marks)**

c. Explain the hydraulic cylinder sequencing circuits with a neat sketch. **(10 Marks)**

Module-4

7 a. Describe the various components used in pneumatic power systems and its symbol. **(05 Marks)**

b. Explain the working of a single acting type of pneumatic cylinder with a neat sketch. **(05 Marks)**

c. Explain the construction and working of lubricator used in pneumatic system with a neat sketch. **(10 Marks)**

OR

8 a. Explain the working of a shuttle valve used in pneumatic system with a neat sketch. **(05 Marks)**

b. What are the various ways the pneumatic cylinders are mounted? **(05 Marks)**

c. Explain the working of solenoid operated valve with a neat sketch. **(10 Marks)**

Module-5

9 a. Explain the speed control pneumatic circuits with a suitable sketch. **(10 Marks)**

b. Explain the OR function of controlling the single acting pneumatic cylinder with a neat circuit. **(10 Marks)**

OR

10 a. Explain the controlling of pneumatic cylinders in a sequence as $A^+ B^+ B^- A^-$ by cascading method. **(10 Marks)**

b. Explain electro pneumatic control of double acting cylinder with a suitable circuit. **(10 Marks)**

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17ME73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Control Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. What is closed loop control system? **(02 Marks)**

b. Explain the closed loop control system with an example. **(08 Marks)**

c. Describe proportional + Integral + Derivative control system with its characteristics. **(10 Marks)**

OR

2 a. What are the requirements of an ideal control system? Explain any three in detail. **(10 Marks)**

b. Explain :

i) Proportional control system

ii) Proportional and integral control system. **(10 Marks)**

Module-2

3 a. Find the transfer function of mechanical system shown in Fig.Q3(a).

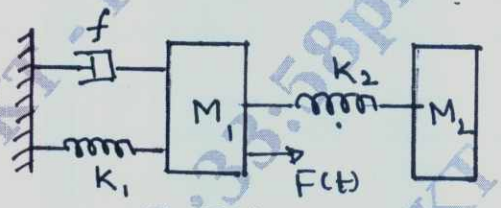

Fig.Q3(a) **(10 Marks)**

b. Draw the signal flow graph for the following set of equations and obtain the transfer function:

$x_2 = a_{12} x_1 + a_{32} x_3 + a_{42} x_4 + a_{52} x_5$

$x_3 = a_{23} x_2$

$x_4 = a_{34} x_3 + a_{44} x_4$

$x_5 = a_{35} x_3 + a_{45} x_4$ **(10 Marks)**

OR

4 a. Derive the differential equation of first order electrical system. **(05 Marks)**

b. A gas filled thermometer has a thermal resistance of R and is filled with a gas whose thermal capacitance is C. Obtain the transfer function relating the temperature of the gas inside the thermometer to the temperature of the medium in which the thermometer is inserted. Neglect capilarity of the thermometer. **(05 Marks)**

c. Determine the transfer function of the system shown in Fig.Q4(c), by block diagram reduction method.

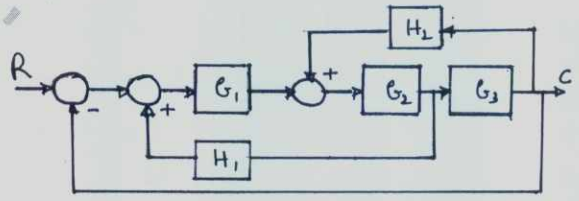

Fig.Q4(c) **(10 Marks)**

Module-3

5 a. A unity feedback control system has $G(s) = \frac{25}{s(s+5)}$. Determine the following quantities if it is subjected to unit step input
i) Rise time
ii) Peak time
iii) Maximum over shoot
iv) Settling time for 2% tolerance. **(08 Marks)**

b. Define : i) Absolute stability ii) Relative stability. **(04 Marks)**

c. Investigate the stability of the control system using R–H criteria. The characteristic equation is $s^4 + 2s^3 + 11s^2 + 18s + 18 = 0$. **(08 Marks)**

OR

6 Sketch the root locus plot for a system whose open loop transfer function :

$$G(s)H(s) = \frac{K[s^2+6s+25]}{s[s+1][s+2]}$$

Show that the system is absolutely stable. **(20 Marks)**

Module-4

7 Draw the BODE plots for the system having the open loop transfer function :

$$G(s)H(s) = \frac{K}{s[s^2+2s+5]}.$$

Determine the value of K to obtain
i) A phase margin of 50° ii) A gain margin of 10db. **(20 Marks)**

OR

8 Determine the stability of the open loop control system

$$G(s)H(s) = \frac{10[s+1]}{s[s-1][s+5]}$$ using Nyquist method. **(20 Marks)**

Module-5

9 a. Explain phase lead compensation. **(08 Marks)**

b. Define : i) State variables ii) State vector. **(04 Marks)**

c. Evaluate the observability of the system with $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ and $C = [3\ \ 4\ \ 1]$

Using Gilbertz test. **(08 Marks)**

OR

10 a. Explain phase lag compensation. **(08 Marks)**

b. What are the advantages of state variable analysis? **(04 Marks)**

c. Obtain the state equation for the mechanical system shown in Fig.Q10(c).

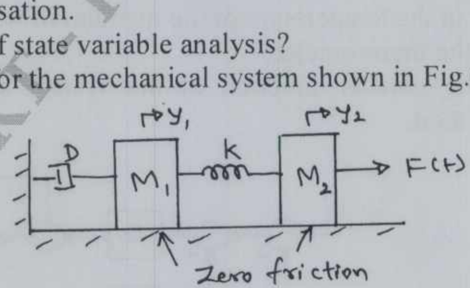

Fig.Q10(c) **(08 Marks)**

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17ME745

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Smart Materials and MEMS

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Missing data may be suitably be assumed.*

Module-1

1 a. What are smart materials? Explain its applications in various fields. **(10 Marks)**
b. Explain Piezo electric properties of smart materials. **(10 Marks)**

OR

2 a. Discuss the vibration control through shape memory alloys. **(10 Marks)**
b. Discuss the advantages of multiplexing embedded NiTiNOL actuators. **(10 Marks)**

Module-2

3 a. Explain the properties and characteristics of Electro rheological and magneto rheological fluids. **(10 Marks)**
b. Discuss the applications of MR/ER fluids in dampers. **(10 Marks)**

OR

4 a. Explain Total internal reflection phenomenon in optical fibers. **(08 Marks)**
b. List the applications of optical fibers as sensors. **(06 Marks)**
c. Explain the working principle of fiber optics in crack detection. **(06 Marks)**

Module-3

5 a. Explain briefly the smart control of structures. **(10 Marks)**
b. Sketch and explain perissoghyro vibration absorber. **(06 Marks)**
c. Write a short note on active vibration absorbers. **(04 Marks)**

OR

6 a. Explain Fibre-Reinforced organic matrix natural composites. **(10 Marks)**
b. Explain the micro structural design of toughness mechanisms in mollusks. **(10 Marks)**

Module-4

7 a. Explain the phenomenon of photolithography. **(10 Marks)**
b. Explain briefly thin film deposition fabrication of MEMS. **(10 Marks)**

OR

8 a. Explain Cantilever piezoelectric actuator-model. **(10 Marks)**
b. Explain the working of Piezo-electric Tactile sensors. **(10 Marks)**

Module-5

9 a. Explain briefly the design and fabrication of channels and valves using MEMS. **(10 Marks)**
b. Elaborate the applications and characteristics of polymer MEMS. **(10 Marks)**

OR

10 a. Discuss the design consideration of MEMS in blood pressure monitoring of patients. **(10 Marks)**
b. Write a short note on MEMS product development. **(10 Marks)**

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CBCS SCHEME

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17ME52

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. What is free body diagram? Explain with simple sketches. **(05 Marks)**

b. In a 4 bar link mechanism shown in Fig Q1(b) the link 4 subjected to a torque $T_4 = 20$N-m. The link length are AD = 800mm, AB = 300mm, BC = 700mm and CD = 400mm. For static equilibrium of the mechanism determine the required input torque T_2 and link 2.

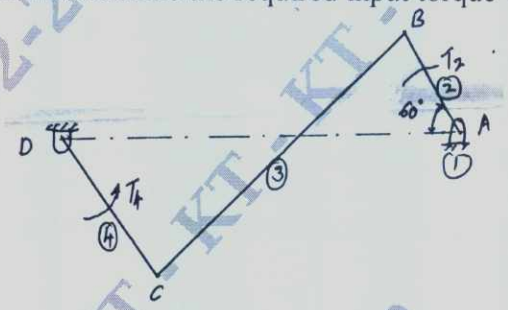

Fig Q1(b) **(15 Marks)**

OR

2 a. State the condition for static equilibrium of a body subjected to a system of i) two forces ii) three forces iii) member with two forces and a torque. **(06 Marks)**

b. A horizontal gas engine running at 210 rpm has a bore of 220mm and a stroke of 440mm. The connecting rod is 924mm long and the reciprocating parts weigh 20kg. When the crank has turned through an angle of 30° from the inner dead centre, the gas pressure on the cover and crank sides are 500kN/m^2 and 60kN/m^2 respectively. Diameter of the piston rod is 40mm. Determine : i) Piston effort ii) thrust in the connecting rod iii) Turning moment on the crank shaft iv) thrust in the bearings. **(14 Marks)**

Module-2

3 a. Briefly explain the static and dynamic balancing. **(04 Marks)**

b. A shaft carries four masses A, B, C and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radii 80mm, 70mm, 60mm and 80mm in a planes measured from A at 300mm, 400mm and 700mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes L and M. The distance between the planes A and L is 100mm between L and M is 400mm. If the balancing masses revolve at a radius of 100mm. Find their magnitudes and angular positions. **(16 Marks)**

OR

4 The crank and connecting rods of a 4-cylinder inline engine running at 1800rpm are 60mm and 240mm each respectively and the cylinders are spaced 150mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an end view in the order 1 – 4 – 2 – 3. The reciprocating mass in each cylinder is 1.5kg. Determine : i) unbalanced primary and secondary forces if any ii) unbalanced primary and secondary couples with reference to the central plane of the engine. **(20 Marks)**

Module-3

5 a. Define the following terms relative to governors :
i) Sensitiveness ii) Isochronism iii) Stability iv) Power. **(08 Marks)**

b. In a Hartnell governor, the extreme radii of rotation of the balls are 40mm and 60mm and the corresponding speeds are 210rpm and 230rpm. The mass of each ball is 3kg. The lengths of the ball and sleeve arms are equal. Determine: i) Spring load at minimum and maximum speeds ii) Spring stiffness iii) initial compression. **(12 Marks)**

OR

6 a. Derive an expression for gyroscopic couple $C = Iww_p$. **(05 Marks)**

b. The turbine rotor of a ship has a mass of 2200kg and rotates at 1800rpm clockwise. When viewed from the stern. The radius of gyration of rotor is 320mm. Determine the gyroscopic couple and its effect when the
(i) ship turns left at a radius of 250m with a speed of 25kmph
(ii) ship pitches with the bow rising at an angular velocity of 0.8 rad/s
(iii) ship rolls at an angular velocity of 0.1rad/s. **(15 Marks)**

Module-4

7 a. Briefly explain free, forced, damped and undamped vibration. **(08 Marks)**

b. Split the harmonic motion $X = 10 \sin (wt + 30°)$ into two harmonic motions, one having a phase angle of zero degree and the other having phase angle of 45°. Also check the solution by graphically. **(12 Marks)**

OR

8 a. Determine the natural frequency of a spring mass system considering mass of the spring into account. **(10 Marks)**

b. Find the natural frequency of the system shown in Fig Q8(b) by using Newton's method. Where m and r are the mass and radius of the disc.

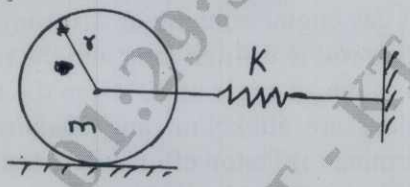

Fig Q8(b) **(10 Marks)**

Module-5

9 a. Define logarithm decrement and derive an expression for the same interms of damping ratio. **(10 Marks)**

b. A vibration system consists of a mass of 50kg, a spring with a stiffness of 30kN/m and a damper. The damping provided is only 20% of the critical value. Determine the i) damping factor ii) critical damping co-efficient iii) natural frequency of damped vibrations iv) logarithmic decrement v) ratio of two consecutive amplitudes. **(10 Marks)**

OR

10 a. Explain the terms :
i) Magnification factor ii) Transmissibility ratio iii) Vibration isolation. **(09 Marks)**

b. A machine of mass 1000kg is acted upon by an external force 2450N at a frequency of 1500rpm. To reduce the effect of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping factor of 0.2 are used. Determine:
i) Transmissibility ratio ii) Force transmitted to the foundation iii) Amplitude of vibration iv) Phase log of the transmitted force with respect to the external force. **(11 Marks)**

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17ME753

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Mechatronics

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Why mechatronics is important to industrial automation? Explain the applications of mechatronics. **(10 Marks)**

b. What are the merits and demerits of mechatronics? **(10 Marks)**

OR

2 a. Define transducer and sensor. List the difference between transducer and sensors. **(08 Marks)**

b. Explain light sensors, proximity switch and hall effect sensors. **(12 Marks)**

Module-2

3 a. Define microprocessor and microcontrollers. With the help of sketch, explain the application of micro processor to automobile system (car). **(10 Marks)**

b. What are the elements of control systems? Mention the difference between microcontroller and microprocessor. **(10 Marks)**

OR

4 a. With the help of block diagram, explain microprocessor. **(08 Marks)**

b. Draw a neat sketch of 8085 microprocessor. Explain different types of registers used in this processor. **(12 Marks)**

Module-3

5 a. Explain principle operation of Programmable Logic Controller (PLC). How PLC is different from microprocessor in control system. **(10 Marks)**

b. What do you mean by ladder diagram? Explain the same with the help of an example. **(10 Marks)**

OR

6 a. Mention robot configuration. Explain yaw pitch and roll pertaining to robot, with the help of diagram. **(10 Marks)**

b. Explain background of actuator in mechatronics system. Explain briefly typical hydraulic actuator and pneumatic actuator. **(10 Marks)**

Module-4

7 a. List the mechanical systems that transmits the power in different planes. **(06 Marks)**

b. With the help of diagram, explain cams used in Internal Combustion (IC) engines. **(10 Marks)**

c. List the mechanical aspects of motor selection. **(04 Marks)**

OR

8 a. How relays are used in mechatronics application? Explain. Explain the working of solenoid switch. **(08 Marks)**

b. With the help of sketch, explain synchronous DC motor and servomotor. **(12 Marks)**

Module-5

9 a. Classify the valves used in mechatronics systems. With the help of sketch, explain pressure reducing valve. **(10 Marks)**

b. Explain cylinders types. Explain rotory actuator. **(10 Marks)**

OR

10 a. With the help of diagram and symbol, explain solenoid operated valve. **(10 Marks)**

b. Briefly explain design and function of various units of hydraulic system. **(10 Marks)**

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