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IES (ESE)-2011 Solution, Answer Key

Mechanical Paper-II

If you found any discrepancy in the options mail to iesacademy@yahoo.com

SET					SET					SET					SET				
Q. No.	A	B	C	D	Q. No.	A	B	C	D	Q. No.	A	B	C	D	Q. No.	A	B	C	D
	Ans.	Ans.	Ans.	Ans.		Ans.	Ans.	Ans.	Ans.		Ans.	Ans.	Ans.	Ans.		Ans.	Ans.	Ans.	Ans.
1	A	A	B	B	31	D	D	D	A	61	B	D	A	A	91	A	A	D	A
2	C	C	D	A	32	A	A	A	B	62	D	B	C	C	92	A	C	A	B
3	C	D	B	D	33	D	A	C	B	63	B	C	D	B	93	A	C	A	C
4	A	D	A	A	34	C	C	B	D	64	A	C	D	D	94	B	C	C	C
5	A	B	A	C	35	B	A	B	B	65	A	A	B	B	95	B	D	A	A
6	B	D	B	B	36	D	D	D	A	66	B	B	D	D	96	A	A	D	D
7	D	D	D	D	37	C	C	D	A	67	D	B	D	D	97	C	D	C	A
8	B	B	B	D	38	A	A	A	C	68	B	A	B	B	98	C	D	A	B
9	B	B	C	A	39	C	D	B	C	69	C	A	B	B	99	A	D	D	A
10	A	A	A	D	40	A	D	C	A	70	A	A	A	D	100	D	A	D	C
11	B	D	A	A	41	D	B	C	A	71	A	D	D	D	101	B	C	B	D
12	A	A	B	C	42	D	D	A	C	72	B	A	A	A	102	A	A	A	A
13	B	D	C	C	43	A	B	D	D	73	C	C	D	A	103	D	D	D	C
14	C	C	C	C	44	C	A	A	D	74	C	B	C	C	104	A	A	A	C
15	B	B	A	D	45	D	A	B	B	75	A	B	B	A	105	C	B	C	A
16	B	D	D	A	46	A	B	B	D	76	D	D	D	D	106	B	B	B	B
17	A	C	A	D	47	C	D	C	D	77	A	D	C	C	107	D	C	D	B
18	D	A	B	D	48	A	B	B	B	78	B	A	A	A	108	D	B	D	A
19	A	C	A	D	49	A	C	A	B	79	A	B	C	D	109	A	A	A	A
20	C	A	C	A	50	D	A	B	A	80	C	C	A	D	110	D	B	D	A
21	A	A	D	C	51	D	A	A	D	81	C	B	A	B	111	A	A	A	D
22	C	C	A	A	52	B	B	B	A	82	B	A	C	D	112	C	B	C	A
23	D	B	C	D	53	B	C	B	D	83	A	D	B	B	113	C	B	C	C
24	D	D	C	A	54	D	C	D	C	84	D	A	D	A	114	C	D	C	B
25	B	B	A	B	55	D	A	B	B	85	D	C	B	A	115	D	B	D	B
26	D	D	B	B	56	B	D	A	D	86	B	B	D	B	116	A	A	A	D
27	D	D	B	C	57	D	A	A	C	87	B	D	D	D	117	D	A	D	D
28	B	B	A	B	58	B	B	C	A	88	C	D	B	B	118	D	C	D	A
29	B	B	A	A	59	C	A	C	C	89	A	A	B	C	119	D	C	D	B
30	A	D	A	B	60	A	C	A	A	90	D	D	D	A	120	A	A	A	C

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Mechanical Engineering Paper-II

Explation of SET-A

Exp. 13. Somnerfield Number $= \frac{\mu N}{P} \left(\frac{d}{c} \right)^2$
Coefficient of friction $(f) = \frac{33}{10^8} \left(\frac{\mu N}{P} \right) \left(\frac{d}{c} \right) + K$

Exp. 18. If the shank of a bolt is reduced to the core diameter, the stress developed in the shank increases, which in turn increases the energy absorption in the shank, thus relieving the material near the threads. Thus, reducing the shank area corresponding to the thread root area results in a design of a bolt of uniform strength.

Exp. 38. Students make common mistake in this question. See length of wire are same so number of coil will be different when the wire will be coiled to different diameter spring

$$L = \pi D_1 n_1 = \pi D_2 n_2$$

$$K = \frac{G d^4}{8 D^3 n}$$

$$\frac{K_1}{K_2} = \frac{\frac{G d^4}{8 D_1^3 n_1}}{\frac{G d^4}{8 D_2^3 n_2}} = \frac{D_2^3 n_2}{D_1^3 n_1} = \frac{D_2^2}{D_1^2} \quad [\because D_1 n_1 = D_2 n_2]$$
$$= \left(\frac{60}{75} \right)^2$$

Exp. 48. Elastomers are a special class of linear polymers that display an exceptionally large amount of elastic deformation when a force is applied. Rubber is the oldest commercial elastomer. Therefore all Rubber are a special type of elastomer. So correct option is elastomer.

Exp. 52. Normalizing reduces the strength of any steel. It relieve all the stress.

Exp. 58. Kevlar Epoxy composite has weight is half of aluminium alloy that so why it is widely used in aerospace industry.

Exp. 63. Columbium finds much use in large-scale applications, such as steel for automobile bodies and pipelines. The use that probably will consume most of the columbium is microalloying. Relatively small amount of columbium lend high strength to steel. The microalloyed, or

high-strength, low-alloy (HSLA) steels, are used for automobile bodies, structures of all kinds, and high-pressure pipe, particularly in the oil and gas industry.

Columbium with oxygen as dominant substitutional alloying atoms is used in the nuclear fusion reactor.

As most of the columbium is consumed by automobile bodies I will go for option (b).

- Exp. 70** Gravity pour casting is used for producing ornamental pieces and jewellery items. As you know jewellers don't have press to pressurize liquid metal.
- Exp. 86** The rake angle does not have any effect on flank but clearance angle has to reduce the friction between the tool flank and the machined surface.
- Exp. 106.** Option (b) Magnetic pulse forming and (d) Electro-hydraulic forming both are High Energy Rate Forming (HERF). But Question is "used for forming components from thin metal sheets or deform thin tubes" it is done by Magnetic pulse forming only.
- Exp. 115.** **Metal excess defects:** In these kinds of defects positive ions are in excess. It is crystalline defects and not done by hammering action therefore (A) is wrong.
- Exp. 117.** Carburizing is done for low carbon steel. If we use high carbon steel it already have wear resistant working surface so we don't need carburizing.
- Exp. 118.** After heat treatment the structural adjustment stabilizer or not it will depends on cooling rate. If very very high cooling rate is used then it unstabilize crystal structure. So (A) is wrong.
- Exp. 119.** Plastic materials cannot easily shaped or molded by **mechanical action** you need heat. Thermoset also a plastic, can you mechanically form it? (A) is wrong.

Explation of SET-B

Exp. 18. Students make common mistake in this question. See length of wire are same so number of coil will be different when the wire will be coiled to different diameter spring

$$L = \pi D_1 n_1 = \pi D_2 n_2$$

$$K = \frac{G d^4}{8 D^3 n}$$

$$\frac{K_1}{K_2} = \frac{\frac{G d^4}{8 D_1^3 n_1}}{\frac{G d^4}{8 D_2^3 n_2}} = \frac{D_2^3 n_2}{D_1^3 n_1} = \frac{D_2^2}{D_1^2} \quad [\because D_1 n_1 = D_2 n_2]$$

$$= \left(\frac{60}{75}\right)^2$$

Exp. 23. Kevlar Epoxy composite has weight is half of aluminium alloy that so why it is widely used in aerospace industry.

Exp. 29. Normalizing reduces the strength of any steel. It releive all the stress.

Exp. 33. Elastomers are a special class of linear polymers that display an exceptionally large amount of elastic deformation when a force is applied. Rubber is the oldest commercial elastomer. Therefore all Rubber are a special type of elastomer. So correct option is elastomer.

Exp. 43. Columbium finds much use in large-scale applications, such as steel for automobile bodies and pipelines. The use that probably will consume most of the columbium is microalloying. Relatively small amount of columbium lend high strength to steel. The microalloyed, or high-strenght, low-alloy (HSLA) steels, are used for automobile bodies, structures of all kinds, and high-pressure pipe, particulary in the oil and gas industry.

Columbium with oxygen as dominant substiutitional alloying atoms is used in the nuclear fusion reactor.

As most of the columbium is consumed by automobile bodies I will go for option (b).

Exp. 50 Gravity pour casting is used for producing ornamental pieces and jewellery items. As you know jewellers don't have press to pressurize liquid metal.

- Exp. 75** The rake angle does not have any effect on flank but clearance angle has to reduce the friction between the tool flank and the machined surface.
- Exp. 86.** Option (b) Magnetic pulse forming and (d) Eletro-hydraulic forming both are High Energy Rate Forming (HERF). But Question is "used for forming components form thin metal sheets or deform thin tubes" it is done by Magnetic pulse forming only.
- Exp. 95.** **Metal excess defects:** In these kinds of defects positive ions are in excess. It is crystalline defets and not done by harmmerring action therefore (A) is wrong.
- Exp. 97.** Carburizing is done for low carbon steel. If we use high carbon steel it already have wear resistant working surface so we don't need carburizing.
- Exp. 98.** After heat treatment the structural adjustment stabilizer or not it will depends on cooling rate. If very very high cooling rate is used then it unstabilize crystal structure. So (A) is wrong.
- Exp. 99.** Plastic materials cannot easily shaped or molded by **mechanical action** you need heat. Theromoset also a plastic, can you mechanically form it? (A) is wrong.
- Exp. 103.** If the shank of a bolt is reduced to the core diameter, the stress developed in the shank increases, which in turn increases the energy absorption in the shank, thus relieving the material near the threads. Thus, reducing the shank area corresponding to the thread root area results in a design of a bolt of uniform strength.

Exp. 108. Somnerfield Number $= \frac{\mu N}{P} \left(\frac{d}{c} \right)^2$

Coefficient of friction (f) $= \frac{33}{10^8} \left(\frac{\mu N}{P} \right) \left(\frac{d}{c} \right) + K$

Explation of SET-C

Exp. 3. Columbium finds much use in large-scale applications, such as steel for automobile bodies and pipelines. The use that probably will consume most of the columbium is microalloying. Relatively small amount of columbium lend high strength to steel. The microalloyed, or high-strenght, low-alloy (HSLA) steels, are used for automobile bodies, structures of all kinds, and high-pressure pipe, particulary in the oil and gas industry.

Columbium with oxygen as dominant substiutitional alloying atoms is used in the nuclear fusion reactor.

As most of the columbium is consumed by automobile bodies I will go for option (b).

Exp. 10 Gravity pour casting is used for producing ornamental pieces and jewellery items. As you know jewellers don't have press to pressurize liquid metal.

Exp. 35 The rake angle does not have any effect on flank but clearance angle has to reduce the friction between the tool flank and the machined surface.

Exp. 43. If the shank of a bolt is reduced to the core diameter, the stress developed in the shank increases, which in turn increases the energy absorption in the shank, thus relieving the material near the threads. Thus, reducing the shank area corresponding to the thread root area results in a design of a bolt of uniform strength.

Exp. 48. Somnerfield Number = $\frac{\mu N}{P} \left(\frac{d}{c} \right)^2$
Coefficient of friction (f) = $\frac{33}{10^8} \left(\frac{\mu N}{P} \right) \left(\frac{d}{c} \right) + K$

Exp. 78. Students make common mistake in this question. See length of wire are same so number of coil will be different when the wire will be coiled to different diameter spring

$$L = \pi D_1 n_1 = \pi D_2 n_2$$

$$K = \frac{G d^4}{8 D^3 n}$$

$$\frac{K_1}{K_2} = \frac{\frac{G d^4}{8 D_1^3 n_1}}{\frac{G d^4}{8 D_2^3 n_2}} = \frac{D_2^3 n_2}{D_1^3 n_1} = \frac{D_2^2}{D_1^2} \left[\because D_1 n_1 = D_2 n_2 \right]$$

$$= \left(\frac{60}{75} \right)^2$$

- Exp. 83.** Kevlar Epoxy composite has weight is half of aluminium alloy that so why it is widely used in aerospace industry.
- Exp. 89.** Normalizing reduces the strength of any steel. It relieve all the stress.
- Exp. 93.** Elastomers are a special class of linear polymers that display an exceptionally large amount of elastic deformation when a force is applied. Rubber is the oldest commercial elastomer. Therefore all Rubber are a special type of elastomer. So correct option is elastomer.
- Exp. 106.** Option (b) Magnetic pulse forming and (d) Eletro-hydraulic forming both are High Energy Rate Forming (HERF). But Question is "used for forming components form thin metal sheets or deform thin tubes" it is done by Magnetic pulse forming only.
- Exp. 115.** **Metal excess defects:** In these kinds of defects positive ions are in excess. It is crystalline defets and not done by hammmering action therefore (A) is wrong.
- Exp. 117.** Carburizing is done for low carbon steel. If we use high carbon steel it already have wear resistant working surface so we don't need carburizing.
- Exp. 118.** After heat treatment the structural adjustment stabilizer or not it will depends on cooling rate. If very very high cooling rate is used then it unstabilize crystal structure. So (A) is wrong.
- Exp. 119. Plastic materials cannot easily shaped or molded by **mechanical action** you need heat. Theromaset also a plastic, can you mechanically form it? (A) is wrong.

Explation of SET-D

Exp. 6. Option (b) Magnetic pulse forming and (d) Eletro-hydraulic forming both are High Energy Rate Forming (HERF). But Question is "used for forming components form thin metal sheets or deform thin tubes" it is done by Magnetic pulse forming only.

Exp. 15. **Metal excess defects:** In these kinds of defects positive ions are in excess. It is crystalline defets and not done by harmmering action therefore (A) is wrong.

Exp. 17. Carburizing is done for low carbon steel. If we use high carbon steel it already have wear resistant working surface so we don't need carburizing.

Exp. 18. After heat treatment the structural adjustment stabilizer or not it will depends on cooling rate. If very very high cooling rate is used then it unstabilize crystal structure. So (A) is wrong.

Exp. 19. Plastic materials cannot easily shaped or molded by **mechanical action** you need heat. Theromaset also a plastic, can you mechanically form it? (A) is wrong.

Exp. 23. If the shank of a bolt is reduced to the core diameter, the stress developed in the shank increases, which in turn increases the energy absorption in the shank, thus relieving the material near the threads. Thus, reducing the shank area corresponding to the thread root area results in a design of a bolt of uniform strength.

Exp. 28. Somnerfield Number = $\frac{\mu N}{P} \left(\frac{d}{c} \right)^2$
Coefficient of friction (f) = $\frac{33}{10^8} \left(\frac{\mu N}{P} \right) \left(\frac{d}{c} \right) + K$

Exp. 58. Students make common mistake in this question. See length of wire are same so number of coil will be different when the wire will be coiled to different diameter spring

$$L = \pi D_1 n_1 = \pi D_2 n_2$$

$$K = \frac{G d^4}{8 D^3 n}$$

$$\frac{K_1}{K_2} = \frac{\frac{G d^4}{8 D_1^3 n_1}}{\frac{G d^4}{8 D_2^3 n_2}} = \frac{D_2^3 n_2}{D_1^3 n_1} = \frac{D_2^2}{D_1^2} [\because D_1 n_1 = D_2 n_2]$$

$$= \left(\frac{60}{75}\right)^2$$

Exp. 63. Kevlar Epoxy composite has weight is half of aluminium alloy that so why it is widely used in aerospace industry.

Exp. 69. Normalizing reduces the strength of any steel. It relieve all the stress.

Exp. 73. Elastomers are a special class of linear polymers that display an exceptionally large amount of elastic deformation when a force is applied. Rubber is the oldest commercial elastomer. Therefore all Rubber are a special type of elastomer. So correct option is elastomer.

Exp. 83. Columbium finds much use in large-scale applications, such as steel for automobile bodies and pipelines. The use that probably will consume most of the columbium is microalloying. Relatively small amount of columbium lend high strength to steel. The microalloyed, or high-strength, low-alloy (HSLA) steels, are used for automobile bodies, structures of all kinds, and high-pressure pipe, particularly in the oil and gas industry.

Columbium with oxygen as dominant substitutional alloying atoms is used in the nuclear fusion reactor.

As most of the columbium is consumed by automobile bodies I will go for option (b).

Exp. 90 Gravity pour casting is used for producing ornamental pieces and jewellery items. As you know jewellers don't have press to pressurize liquid metal.

Exp. 115 The rake angle does not have any effect on flank but clearance angle has to reduce the friction between the tool flank and the machined surface.

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Solution, Answer Key

Engineering Service Examination-2011